

Review

Family Presence During Adult Resuscitation From Cardiac Arrest: A Systematic Review

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PII: S0300-9572(22)00656-6  
DOI: <https://doi.org/10.1016/j.resuscitation.2022.08.021>  
Reference: RESUS 9586

To appear in: *Resuscitation*

Received Date: 1 August 2022  
Revised Date: 29 August 2022  
Accepted Date: 30 August 2022

Please cite this article as: J. CONSIDINE, K. EASTWOOD, H. WEBSTER, M. SMYTH, K. NATION, R. GREIF, K. DAINTY, J. FINN, J. BRAY, Family Presence During Adult Resuscitation From Cardiac Arrest: A Systematic Review, *Resuscitation* (2022), doi: <https://doi.org/10.1016/j.resuscitation.2022.08.021>

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# FAMILY PRESENCE DURING ADULT RESUSCITATION FROM CARDIAC ARREST: A SYSTEMATIC REVIEW

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## Word count

Abstract 247 words

Manuscript 4194 words

## ABSTRACT

### AIM

**Objective:** To conduct a systematic review of the published evidence related to family presence  
during adult resuscitation from cardiac arrest.

## METHODS

This review, registered with PROSPERO (CRD42021242384) and reported according to PRISMA guidelines, included studies of adult cardiac arrest with family presence during resuscitation that reported one or more patient, family or provider outcomes. Three databases (Medline, CINAHL and EMBASE) were searched from inception to 10/05/2022. Two investigators screened the studies, extracted data, and assessed risks of bias using the Mixed Method Appraisal Tool (MMAT). The synthesis approach was guided by Synthesis Without Meta-Analysis (SWiM) reporting guidelines and a narrative synthesis method.

## RESULTS

The search retrieved 9,459 citations of which 31 were included: 18 quantitative studies (including two RCTs), 12 qualitative studies, and one mixed methods study. The evidence was of very low or low certainty. There were four major findings. High-certainty evidence regarding the effect of family presence during resuscitation on patient outcomes is lacking. Family members had mixed outcomes in terms of depression, anxiety, post-traumatic stress disorder (PTSD) symptoms, and experience of witnessing resuscitation. Provider experience was variable and resuscitation setting, provider education, and provider experience were major influences on family presence during resuscitation. Finally, providers reported that a family support person and organisational guidelines were important for facilitating family presence during resuscitation.

## CONCLUSION

The effect of family presence during resuscitation varies between individuals. There was variability in the effect of family presence during resuscitation on patient outcomes, family and provider outcomes and perceptions.

**Keywords:** Adult; Cardiopulmonary Resuscitation; Family; Family Health; Health Personnel; Heart Arrest; Humans; Outcome Assessment, Health Care; Stress, Psychological; Treatment Outcome

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# FAMILY PRESENCE DURING ADULT RESUSCITATION FROM CARDIAC ARREST: A SYSTEMATIC REVIEW

## INTRODUCTION

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Depending on context (out-of-hospital versus in-hospital), family presence during adult

resuscitation may be inevitable, incidental or invited. Given the sudden nature of cardiac arrest and low likelihood of patient survival,<sup>1-5</sup> family members may or may not wish to be present during resuscitative efforts.<sup>6</sup> Advocates of family presence during resuscitation cite improved coping and grieving outcomes for families, reduced litigation, and improved resuscitation team behaviours.<sup>6-8</sup> Conversely, the major concerns about family presence during resuscitation are family or healthcare provider distress, and negative impact on team performance.<sup>6,9</sup>

### Rationale

International resuscitation guidelines support family presence during resuscitation.<sup>10-13</sup> A 2015 systematic review and meta-analysis of randomised controlled trials (RCTs) (three adult and one paediatric) showed offering family presence during resuscitation (defined as resuscitation for shock, cardiac arrest, or trauma), made no difference to resuscitation duration, or prehospital, emergency department (ED) or hospital mortality in adults and children.<sup>6</sup> Moreover, family members offered presence during adult resuscitation had less post-event anxiety, depression and intrusive thoughts.<sup>6</sup> In 2021, an International Liaison Committee on Resuscitation (ILCOR) systematic review of family presence during neonatal and paediatric resuscitation showed parents/family members wanted the option to be present for their child's resuscitation; wide variation in healthcare provider attitudes towards family presence resuscitation; and insufficient evidence to demonstrate the effect of family presence during resuscitation on patient or family outcomes.<sup>14</sup> Family presence during paediatric or neonatal resuscitation may be a positive experience for some parents, but both healthcare providers and family members had concerns about family presence adversely impacting on resuscitation team performance.<sup>14</sup> The data in adults are less clear and systematic reviews related to family presence

during adult resuscitation have focused on RCTs that may not provide a comprehensive understanding of the research evidence to date, or used broad definitions of resuscitation, not limited to CPR.

## **Objective**

The aim of this systematic review was to evaluate the research evidence related to the effects of family presence during adult resuscitation from cardiac arrest on patient, family, and provider outcomes.

## **METHODS**

This systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.<sup>15</sup> The study protocol was published in the International Prospective Register of Systematic Reviews (PROSPERO, CRD42021242384).<sup>16</sup>

### **Eligibility criteria**

The inclusion criteria were studies: i) of adults in cardiac arrest in any setting, ii) with family presence during resuscitation, iii) with or without a comparator of family absence during resuscitation, and iv) that reported one or more of patient, family, or provider outcomes. All study designs were eligible for inclusion. Studies of hypothetical situations or opinions were excluded as were unpublished studies, conference abstracts, trial protocols, and theses. All years and languages were included if there was an English abstract. There was no universal definition of family so for the purposes of this systematic review, 'family' was defined according to each individual study.

### **Information sources and search strategy**

MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Excerpta Medica Database (EMBASE) databases were searched from inception to 10 May 2022. The search strategy was developed in consultation with a medical information specialist (Alfred Health,

Victoria, Australia) using the concepts of resuscitation, family presence, and adults (Appendix 1).

Adult was defined as per each database.

## Selection process

Citations were uploaded into EndNote 20.0<sup>TM</sup> and duplicates removed. Title and abstract screening and full text screening were conducted by three pairs of researchers (JC and MS, JB and HW, KE and KN) using the Rayyan<sup>17</sup> software program and disagreements were resolved by discussion and consensus.

## Data collection process and data items

Data were extracted by a single author (JC) and ratified by co-authors (JF, JB, MS, KN, KE, HW). The following characteristics of each study were extracted: author(s); year of publication; country of origin; aim and study design; population and data collection methods; intervention and comparator; outcomes measured and main findings. The specific outcomes of interest were:

- i) patient outcomes (short and long term): return of spontaneous circulation (ROSC), survival (to hospital admission, hospital discharge at three months, six months, one year), survival with good neurological outcomes (at same time points), patient depression and anxiety.
- ii) family (or significant other) outcomes: short and long term post-traumatic stress disorder (PTSD) symptoms (re-experiencing, avoidance or increased arousal), experience of perceptions of the resuscitation, depression and anxiety amongst family members.
- iii) healthcare provider outcomes: perceptions of the resuscitation, performance, perceived futility, psychological stress.

## **Risk of bias (quality) assessment**

Risk of bias was assessed independently by two researchers (in the three groups identified above) using the Mixed Method Appraisal Tool (MMAT)<sup>18</sup> that was deemed appropriate given this

systematic review included quantitative, mixed-method and qualitative studies.

## **Synthesis methods**

Given the anticipated variation in study design, populations, and outcomes, a meta-analysis was thought unlikely to be possible. The synthesis approach was guided by the Synthesis Without Meta-Analysis (SWiM) reporting guidelines<sup>19</sup> and narrative synthesis methods.<sup>20</sup> Synthesis was stratified for each sub-group (patient, family and healthcare provider) and interpretation of the synthesis was by discussion within the research team and resuscitation science experts from the ILCOR Education, Implementation and Teams, Basic Life Support and Advanced Life Support Task Forces.<sup>21</sup>

## **RESULTS**

### **Study selection**

In total, 11,457 citations were retrieved (9,459 citations following duplicate removal ), and 243 full text publications were screened for eligibility, of which 30 were included (Figure. 1). One additional reference fulfilling the inclusion criteria was identified via searching reference lists of included studies resulting in 31 inclusions. It should be noted that the papers by Hassankhani et al.<sup>22,23</sup> included the same participants (less one doctor<sup>22</sup>) and the 2018 paper by Giles et al.<sup>24</sup> drew on a subset of participants from their 2016 work.<sup>25</sup> As these papers were qualitative in nature and intended to answer different research questions, they were treated as separate studies and all four included.



## Study characteristics

The characteristics of included studies are summarised in Table 1: further details are presented in Supplementary Tables 1 to 6. There were 18 quantitative studies<sup>26-43</sup> (including two RCTs<sup>28,43</sup>), 12 qualitative studies,<sup>44-52</sup> and one mixed methods study.<sup>53</sup> Patient outcomes were reported in 12 studies (Supplementary Tables 1 and 6).<sup>25-27,29,30,37,42,43,45,46,48,52</sup> Family outcomes were reported in 15 studies (Supplementary Tables 2, 3 and 6),<sup>25,28-33,41,43-48,52</sup> and provider outcomes were reported in 20 studies (Supplementary Tables 4, 5 and 6).<sup>22-25,28,32-40,42,43,49-52</sup>

The included studies spanning almost four decades (1986<sup>33</sup> to 2021<sup>28,42</sup>) were commonly from the United States (n=8)<sup>26,31,32,35,37,41,48,52</sup> or United Kingdom (n=4).<sup>40,47,50,51</sup> Five studies reported on out-of-hospital resuscitation,<sup>29,41,43,44,49</sup> 24 studies reported on in-hospital resuscitation,<sup>22-28,30-40,42,45,46,48,50,52</sup> one study reported on both in- and out-of-hospital resuscitation.<sup>51</sup> In one study the resuscitation context was unclear.<sup>47</sup> Studies of in-hospital resuscitation were located in the ED (n=12),<sup>22-25,28,31-35,40,51</sup> intensive care unit (ICU) (n=6),<sup>24-26,35,36,48</sup> coronary care unit (n=2),<sup>22,23</sup> critical care areas (undefined) (n=2),<sup>45,50</sup> and all hospital areas (n=6).<sup>24,25,27,37,42,52</sup> In three in-hospital studies the context was unreported,<sup>30,38,39</sup> and in eight studies more than one in-hospital location was reported.<sup>22-25,35,42,51,52</sup>

## Quality assessment

The major sources of bias in qualitative studies (n=12)<sup>22-25,44-51</sup> were lack of coherence<sup>45,46</sup> or undetermined coherence<sup>24,25,48</sup> between data sources, collection, analysis and interpretation; lack of clarity regarding the findings being derived from the data;<sup>45,46,48</sup> or difficulty substantiating interpretation of the results (Supplementary Table 7).<sup>45,46,48,49</sup> For the two RCTs<sup>28,43</sup> it was not possible to ascertain group equivalence at baseline. The assessors were not blinded to the intervention in one RCT<sup>28</sup> and the other RCT had incomplete outcome data.<sup>43</sup> One RCT focused on offering relatives a choice to witness resuscitation versus traditional family care during out-of-

hospital resuscitation.<sup>43</sup> However, this study had family presence and family absence in both intervention and control groups, and the intervention group had supplementary care strategies in addition to family presence during resuscitation.<sup>43</sup>

For non-randomised quantitative studies (n=8),<sup>26,27,30,31,33,40-42</sup> bias was related to potential between group differences due to lack of randomisation, and in three studies, inability to ascertain completeness of outcome data.<sup>27,30,33</sup> For quantitative descriptive studies (n=8),<sup>30,32,34-39</sup> non-response bias was an issue in five studies<sup>29,34,35,38,39</sup> and could not be ascertained in two studies.<sup>32,52</sup> It was not possible to ascertain if the sample was representative of the target population in four studies.<sup>32,35,37,38</sup> The single mixed methods study<sup>52</sup> did not adequately address the divergences and inconsistencies between quantitative and qualitative results.

## Patient outcomes

Eleven studies reported quantitative measures of patient outcomes: 10 observational studies<sup>26,27,29,30,37,42,45,46,48,52</sup> and one RCT.<sup>43</sup> Families were both present and absent in RCT intervention and control groups, so results related to family presence versus absence during resuscitation was included in preference to intervention versus control groups.<sup>43</sup> The most commonly reported patient outcome was survival at various time-points (ROSC,<sup>27,37,43,45,46</sup> 12 hours,<sup>46</sup> hospital discharge,<sup>26</sup> hospital admission,<sup>43</sup> 11 months,<sup>46</sup> 28-days,<sup>30,43</sup> 30-days,<sup>42</sup> 90-days,<sup>29</sup> unreported<sup>48,52</sup>). In three studies, family presence made no significant difference to ROSC<sup>27,42,43</sup> and in one study, ROSC was significantly lower when families were present (p=0.02).<sup>26</sup> In one study, survival to hospital discharge was significantly lower when families were present in both unadjusted (p=0.04) and adjusted analyses (p=0.03),<sup>26</sup> but two other studies showed no difference in 28-day survival,<sup>43</sup> or 30-day survival<sup>42</sup> respectively. There were conflicting results for resuscitation duration. Compared to patients with no family present, patients with family present during resuscitation had significantly shorter resuscitation duration in one study (23.5 versus 30 minutes,

$p<0.001$ ),<sup>27</sup> significantly longer resuscitation duration in one study (20.7 vs 17.5 minutes,  $p=0.03$ )<sup>42</sup> and no significant difference in two studies.<sup>26,43</sup> A single qualitative study of factors influencing family presence during resuscitation included an interview with one patient participant who survived their cardiac arrest during which a family member was present. In this study, patient results were integrated with family (including the patient's relative) and provider perspectives.<sup>25</sup>

## **Family outcomes**

The most common family outcomes reported using quantitative approaches were depression,<sup>29-31,43</sup> anxiety,<sup>28-30,43</sup> PTSD symptoms,<sup>30,31,41,43</sup> and experience of witnessing resuscitation.<sup>32,33</sup> The results for each outcome are considered separately below. Unless otherwise stated, these studies compared outcomes of families who were and were not present during resuscitation. Five qualitative studies<sup>44-48</sup> and one mixed-methods study<sup>52</sup> reported family outcomes. Four examined family members' experiences in out-of-hospital,<sup>44</sup> in-hospital,<sup>45,48,52</sup> both in- and out-of-hospital resuscitation.<sup>46</sup> One study did not report the setting.<sup>47</sup> Perceptions of family members, family needs, and cultural and religious issues during in-hospital resuscitation were reported in one study<sup>48</sup> and another focused on factors influencing family presence during in-hospital resuscitation from patient, family and provider perspectives.<sup>25</sup>

### *Depression*

There were conflicting results regarding depression in family members present during resuscitation and variation in the time-points measured. Witnessing resuscitation was an independent predictor of depression at 90-days in one study (OR=6.71; 95%CI=1.27-35.34,  $p=0.03$ ) (adjusted for age & gender).<sup>29</sup> Conversely, one study found families present during resuscitation had less depression at 90-days (RR=0.26; 95%CI=0.12-0.58),<sup>30</sup> and another found presence during resuscitation was associated with fewer depression symptoms (15% vs 26% vs  $p=0.009$ ) at 90-days.<sup>43</sup> One study found no significant differences in depression at 30-days.<sup>31</sup>

### *Anxiety*

Family presence during resuscitation was associated with less anxiety (RR=0.07; 95%CI=0.02-

0.15) and anxiety symptoms (10% vs 27%,  $p<0.001$ ) at 90-days. In the absence of a

comparison group, no significant relationship was identified between family members witnessing resuscitation and their anxiety at 90-days.<sup>29</sup>

### *Post-traumatic Stress Disorder (PTSD) symptoms*

There were conflicting results regarding PTSD symptoms. Two studies<sup>30,43</sup> reported family members present during resuscitation had less PTSD at 90-days (RR=0.05; 95%CI=0.01-0.15;<sup>30</sup> 27% vs 41%,  $p=0.001$ <sup>43</sup>). One study reported that family members witnessing resuscitation had significantly higher PTSD symptom scores (14.47 vs.7.60,  $p=0.03$ ; mean difference=6.87, 95%CI=0.57-13.17),<sup>41</sup> and another reported higher likelihood of experiencing increased arousal at 60-days post event (40.9% vs 13.9%: mean difference 27.0%, 95%CI=3.6-50.4%).<sup>31</sup> One study reported no significant difference in PTSD symptoms (re-experiencing, avoidance or increased arousal) between family members present and not present during resuscitation at 30-days post event.<sup>31</sup> Another study, after controlling for out-of-hospital cardiac arrest location, reported duration of the relationship with the patient, and whether or not the patient's death was anticipated, witnessing resuscitation was associated with significantly higher PTSD symptoms (parameter estimate=11.9, 95%CI=5.05-18.8,  $p=0.001$ ).<sup>41</sup>

### *Family members' experience of being present during resuscitation*

Two studies surveyed family members about their experience of witnessing resuscitation.<sup>32,33</sup> In one study, all (n=24) family members stated they would witness the resuscitation again and believed their presence enabled better coping with grief.<sup>32</sup> Similarly, the other study reported that all (n=47) family members present felt that staff had 'done everything', 94% would witness

resuscitation again, and 77% felt that witnessing resuscitation efforts facilitated adjustment to their family member's death.<sup>33</sup> In the same study two thirds of family members who witnessed resuscitation felt their presence was meaningful to their dying family member (64%) and helped them die peacefully (62%), but 16% felt the resuscitation was too long and was perhaps extended for their benefit.<sup>33</sup> One family member (of 48 participants) reported that questionnaire completion caused extensive emotional suffering.<sup>33</sup> The remaining studies collected data via interviews.<sup>25,44-48,52</sup> Intervals between resuscitation events and interviews ranged from <24 hours<sup>48</sup> to 40 years:<sup>25</sup> the most common interval was two to three months.<sup>44,45,52</sup> In one study, 100% of family members indicated it was important and helpful for them to be there.<sup>52</sup>

There were different themes and subthemes reported in qualitative studies.<sup>44-48</sup> Key concepts regarding family needs centred around choice whether to be present;<sup>44,46</sup> being physically and emotionally present;<sup>44,45,47,48</sup> need for information and communication with providers;<sup>44,45,48</sup> and need for support (physical, emotional and spiritual).<sup>45,48</sup> Other studies reported notions of families knowing that 'everything was done'<sup>44,46</sup> and that during resuscitation there were moments of hope,<sup>46</sup> or alternatively, likely death became apparent.<sup>44</sup> Some studies reported family members found resuscitation a brutal and dehumanising experience<sup>44</sup> that was distressing,<sup>44,46</sup> and causing worry about trying to remove thoughts about the resuscitation.<sup>46</sup> Family members reported being afraid of interfering or disrupting resuscitative efforts<sup>46</sup> or losing emotional control,<sup>46</sup> and others perceived excessive or unnecessarily heroic approaches to resuscitation.<sup>44</sup>

Family member regret was reported in three studies.<sup>25,43,47</sup> In one study,<sup>43</sup> 12% of family members not present expressed regret at being absent and 3% of relatives who witnessed CPR regretted being present ( $p<0.001$ ).<sup>43</sup> In one qualitative study, no family members regretted being present,<sup>25</sup> and in another some participants reported regretting witnessing resuscitation.<sup>47</sup> Family member behaviours during resuscitation were reported in one study: communication with the team (67%), asking for

explanations (30%), crying (33%) and appearing 'frozen' (29%) were common and negative behaviours such as agitation (8%), aggression (1%) and conflict (1%) were uncommon.<sup>43</sup>

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The most common provider outcomes reported using quantitative methods were experience with,<sup>34-39,52</sup> or perceptions of, family presence during resuscitation,<sup>22-24,33,34,37,49-52</sup> provider anxiety<sup>28</sup> or stress.<sup>40</sup> One in-hospital cardiac arrest registry study reported on processes of family presence during resuscitation.<sup>42</sup> Six qualitative studies reported provider experiences of family presence during out-of-hospital,<sup>49</sup> in-hospital,<sup>22-24,50</sup> or both in- and out-of-hospital resuscitation.<sup>51</sup> One qualitative study reported factors impacting family presence during in-hospital resuscitation from patient, family and provider perspectives.<sup>25</sup>

### *Provider experience with family presence during resuscitation*

Provider experience with family presence during resuscitation was reported in seven quantitative studies (largely survey methods<sup>34-39,52</sup> and one in-hospital cardiac arrest registry study<sup>42</sup>), and six qualitative studies (one out-of-hospital,<sup>49</sup> four in-hospital,<sup>22-24,50</sup> and one covering both in-hospital resuscitation by registered nurses and out-of-hospital resuscitation by ambulance staff<sup>51</sup>). Only three studies reported the frequency of family presence:<sup>37,42,52</sup> 47% during out-of-hospital resuscitation,<sup>52</sup> and 29% to 46% during in-hospital resuscitation.<sup>37,42</sup> Family presence during in-hospital resuscitation was more likely in critical care areas than general wards (52% vs 47%,  $p=0.02$ ).<sup>42</sup>

Provider-reported experience with family presence during resuscitation ranged from 35% to 63%<sup>34-36,38,39</sup> and was and less likely for ED (versus ICU) clinicians (OR =0.49, 95%CI=0.28-0.87,  $p=0.01$ ).<sup>35</sup> Provider-reported experience of family members requesting to be present during resuscitation ranged from 11% to 22%.<sup>35,38,39</sup> Provider-reported experience of inviting families to be present during resuscitation ranged from never to 13%.<sup>35,38,39</sup> In one study, inviting families to

stay during the resuscitation was more likely in critical care areas compared with general wards (44% vs 26%,  $p<0.001$ ).<sup>42</sup>

#### Journal Pre-proofs

Positive experiences of family presence during resuscitation were reported by 5.5%<sup>35</sup> to 22.4%<sup>35</sup> of providers<sup>35,36,38,39</sup>.<sup>35</sup> Negative experiences of family presence were reported by 18.3%<sup>36</sup> to 33.5%<sup>39</sup> of providers<sup>35,36,38,39</sup> and were also more likely in those in clinical roles (versus managers, educators or researchers)(OR=0.30, 95% CI=0.10-0.90,  $p=0.03$ ).<sup>35</sup> No association was found between experience of family presence during resuscitation and years of practice in current specialty and frequency of CPR per week.<sup>35</sup>

Negative experiences of healthcare providers reported in qualitative studies included families preventing or interfering with resuscitation,<sup>23</sup> aggressive or disruptive family behaviours,<sup>23,51</sup> and provider concern about family trauma and heightened awareness of negative and visually distressing images.<sup>23,50,51</sup> Positive experiences were that the resuscitation team could provide reassurance to families,<sup>23</sup> the opportunity for collaboration between providers and families in providing patient care, comfort and physical closeness,<sup>23,50,51</sup> and providers alleviating family concerns, guiding families through a traumatic experience and responding to families' existential needs.<sup>23,49,50</sup>

#### *Factors influencing provider experience of family presence during resuscitation*

Provider knowledge<sup>49</sup> and experience<sup>22,50</sup> were key to managing the stress of family presence during resuscitation and family distress. A number of studies reported internal conflicts for providers in balancing compassionate care and technical competence,<sup>50,51</sup> reconciling unsettling emotions with their professional practice responsibilities,<sup>50</sup> moving from patient to family care,<sup>49</sup> and resolving feelings of guilt and failure associated with termination of resuscitation or discomfort with performing futile resuscitation.<sup>49</sup> Divergent practices were also identified within and across in- and out-of-hospital resuscitation.<sup>24,51</sup> Family presence during out-of-hospital resuscitation was seen as

the norm and families may participate in the resuscitation.<sup>51</sup> Families were free to come and go, and there was less professional dominance in the out-of-hospital context.<sup>51</sup> Conversely in the hospital setting, family presence during resuscitation was highly planned and occurred by invitation or

demand. Families were passive observers, their presence or absence dependent on provider judgement, and families were disempowered by professional dominance of providers.<sup>51</sup> Providers wanted to 'do what's best', minimise harm and maximise benefits<sup>24</sup> when allowing or denying family presence during resuscitation, however providers' interpretations of "what's best" did not always match family preferences.<sup>24</sup>

A family facilitator was present in 70% (22/31) of family witnessed resuscitations in one in-hospital study, and was most commonly a registered nurse (41%).<sup>37</sup> Between 0%<sup>39</sup> to 8%<sup>35</sup> of providers reported unit based policies or protocols for family presence during resuscitation.<sup>34,38,39</sup> Experience alone was reported as inadequate for effective family support,<sup>49</sup> and the need for a family support person,<sup>22,37,43</sup> institutional guidelines for family presence during resuscitation,<sup>38,39</sup> and specific provider training to manage families<sup>49</sup> were reported as important in some studies.

### *Provider perceptions of family presence during resuscitation*

Four in-hospital quantitative studies<sup>33,34,37,52</sup> reported provider perceptions of family presence during resuscitation. The majority of providers (74% to 76%) from two studies were supportive of family presence<sup>33,52</sup> and up to 68% in two studies believed there was no impairment to their function as a resuscitation team member.<sup>32,33</sup> In one study, nurses were more likely to be supportive of family presence than attending physicians (96% vs 79%,  $p=0.05$ ) or resident medical officers (96% vs 19%,  $p<0.001$ ), and attending physicians were more likely to be supportive of family presence than residents (79% vs 19%,  $p=0.001$ ).<sup>52</sup> A minority believed that family presence hindered care in terms of clinical performance (8.3%),<sup>34</sup> and interruptions (13.1%);<sup>34</sup> 12% agreed or strongly agreed that family members interfered in care,<sup>37</sup> and 12% agreed or strongly agreed that



team communication was negatively affected by family presence.<sup>37</sup> Providers believed that the patient benefited from family presence (50%),<sup>37</sup> family members benefited by being present (69%),<sup>37</sup> and family members were able to emotionally tolerate being present (58%).<sup>37</sup>

### *Anxiety*

The one in-hospital study of provider (medical staff) anxiety reported higher mean anxiety scores (8.0/10 vs 3.0/10) if resuscitation was witnessed by family members.<sup>28</sup>

### *Stress*

Two studies compared provider stress when families were present versus absent during resuscitation.<sup>40,43</sup> The in-hospital study showed no difference in provider reports of one or more symptoms of stress (49% versus 46%) or two or more symptoms of stress (26.5% versus 18.5%) (no p values reported) and no significant differences in the presence of one or two stress reactions between professional groups (doctors, nurses or healthcare assistants).<sup>40</sup> The out-of-hospital study showed no difference in provider stress scores however emergency physicians had higher stress scores than nurses or ambulance drivers (p-values not reported).<sup>43</sup>

## **DISCUSSION**

This systematic review had four major findings. First, there was a lack of high-certainty evidence regarding the effect of family presence during resuscitation on patient outcomes. Second, family members had mixed outcomes in terms of depression, anxiety, PTSD symptoms, and experience of witnessing resuscitation. Third, provider experience of family presence was variable and resuscitation setting, provider knowledge and experience were major influences on family presence during resuscitation. Finally, providers reported that a family support person and organisational guidelines were important for facilitating and operationalising family presence during resuscitation.

The findings of this systematic review resemble those of other reviews of family presence during resuscitation. Two systematic reviews (one on neonatal and paediatric resuscitation,<sup>14</sup> one on resuscitation more broadly than CPR<sup>6</sup>) failed to show high quality evidence regarding the effect of family presence on patient outcomes. In our review, only two studies measured provider anxiety<sup>28</sup> or stress<sup>40</sup> however provider distress and internal conflict were reported in a number of studies.<sup>49-51</sup> Previous systematic reviews had differing results regarding mental health outcomes with one showing no effect of family presence during paediatric or neonatal resuscitation on parents or providers,<sup>14</sup> and another showing a reduction anxiety and depression symptoms in families present during adult resuscitation.<sup>6</sup>

Our systematic review supports other review findings,<sup>6,9,14,53</sup> highlighting that the majority of family members choose to be present if faced with resuscitation again; however, importantly not all family members wished to be present during resuscitation.<sup>44,46,47,9,14,53</sup> Despite choice being important to family members,<sup>6,14,53</sup> reports of families requesting or being invited to be present during resuscitation were uncommon in our review. Our review showed that, for family members, ‘being there’ was meaningful and physical proximity, information and family support were important,<sup>44-48</sup> confirming notions of ‘being there’, having a physical, emotional or spiritual connection to the patient, and seeing that ‘everything was done’ reported in narrative and integrative reviews of family presence during resuscitation.<sup>9,53</sup>

Variation in provider opinions and attitudes towards family presence during resuscitation is reported in the literature,<sup>9,14,53</sup> with positive perceptions in those with previous experience of family presence during resuscitation and senior providers.<sup>14</sup> Our review also showed that resuscitation setting<sup>51</sup> and provider knowledge<sup>22,50</sup> were major influences on family presence during resuscitation. The need for provider education and training to support families during resuscitation was raised in previous reviews and was desired by both family members and providers.<sup>9,14,53</sup>

## Strengths and limitations

Only two included studies were RCTs,<sup>28,43</sup> and this would typically highlight a research gap. RCTs, apart from those with a step-wedge design, may not be ethical nor the best way to answer research questions regarding family presence during resuscitation. There was variability in the rigour of included studies and their clinical and methodological heterogeneity meant definitive comments regarding certainty of evidence were difficult. As highlighted, one RCT had family presence and family absence in both intervention and control groups, and the intervention group had supplementary care strategies in addition to family presence during resuscitation.<sup>43</sup> Eleven studies used survey methods<sup>28,32-40,52</sup> and 16 studies used interviews,<sup>22-25,29,31,41,44-52</sup> so were subject to selection bias. Further, recall bias was an issue in studies with long intervals between the resuscitation event and interview. The *apriori* plan to undertake subanalyses for out-of-hospital versus ED vs in-hospital cardiac arrests as not possible given the few studies of out-of-hospital cardiac arrest and heterogeneity of included studies. The major strengths of this systematic review were its comprehensive nature and inclusion of studies using different research methods. The included studies spanned 36 years and 12 countries, were of family presence during actual resuscitations, and the inclusion of mixed methods and qualitative studies added depth and richness to the review findings.

## Implications

There are research and clinical implications from this review. The majority of included studies (23/30) reported on in-hospital resuscitation, highlighting a gap in knowledge regarding out-of-hospital resuscitation, where providers have more exposure and less control over family presence during resuscitation. None of the included studies aimed to test the effect of family presence on resuscitation performance or outcomes *a priori*, highlighting a need for well-designed comparative studies focused on patient outcomes. Despite numerous international guidelines supporting family

presence during resuscitation, there is a need for education and training for providers supporting families present during resuscitation, and organisational guidelines and policies to guide family care during resuscitation, coupled with future research to evaluate the factors that result in a positive experience for families and providers. There is also a need to address potential cultural and religious influences upon families and providers that could impact resuscitation efforts during family presence as well as the desire for family presence itself. Due to the paucity of available information these issues were not evaluated here and represent important knowledge gaps.

## **Conclusions**

The limited available evidence regarding family presence during adult resuscitation was very low or low certainty. Patient outcomes were reported in 12 studies and family outcomes reported in 15 studies. Our review showed variability in practices and outcomes of family presence during resuscitation, but given the high desire for family choice, and potential positive outcomes for families, international resuscitation guidelines are likely to advocate for family choice regarding their presence during resuscitation. Future research should focus on testing interventions such as provider training programs, use of family support persons and implementation of organisational guidelines and policies to reduce the individual decision burden, facilitate and operationalise care of families during adult resuscitation.

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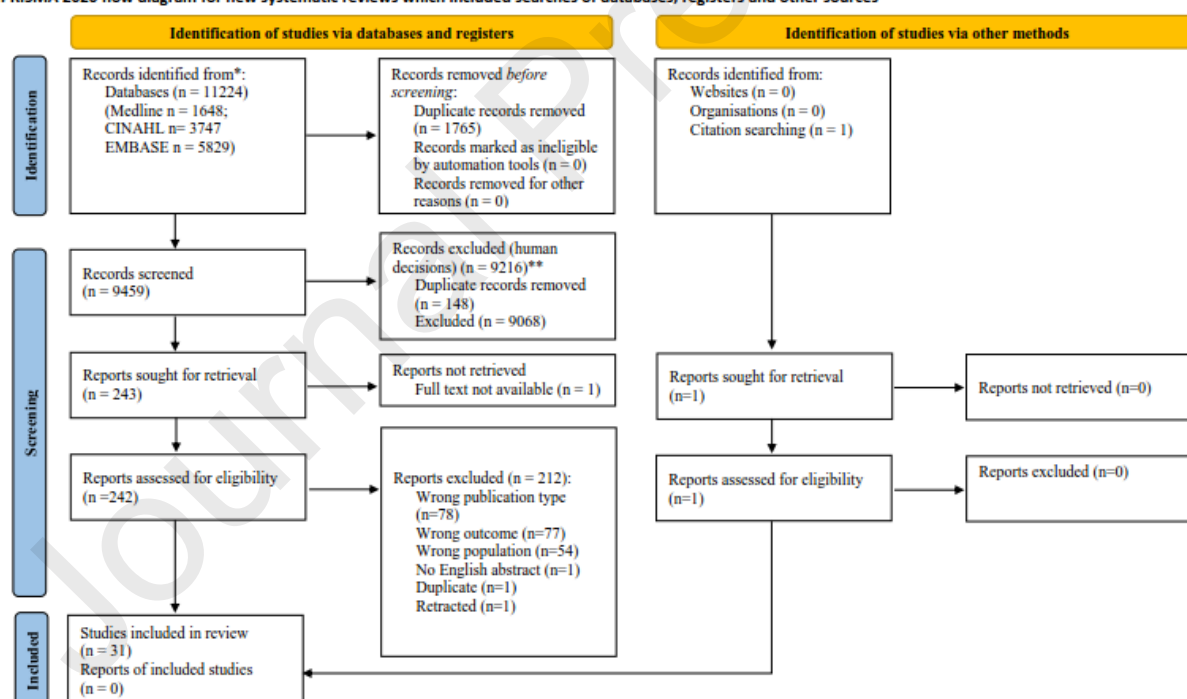
Journal Pre-proofs

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## Conflicts of Interest

This systematic review was part of the ILCOR continuous evidence evaluation process, which is guided by a rigorous conflict of interest policy (see [www.ilcor.org](http://www.ilcor.org)). Kathryn Eastwood is a member of the International Liaison Committee on Resuscitation (ILCOR) Education Implementation and Teams (EIT) Task Force. Kevin Nation was a member of the ILCOR Advanced Life Support (ALS) Task Force at the commencement of this systematic review and is now a member of the ILCOR EIT Task Force. Robert Greif is European Resuscitation Council Director of Guidelines and ILCOR, and ILCOR EIT Taskforce Chair. Julie Considine is an emeritus member of ILCOR Basic Life Support (BLS) Task Force and Katie Dainty is a member of the ILCOR BLS Task Force. Janet Bray is ILCOR BLS Task Force Chair and Michael Smyth is Deputy Chair. Judith Finn is a member of the ILCOR Science Advisory Committee. None of the other authors declared a conflict of interest.

PRISMA 2020 flow diagram for new systematic reviews which included searches of databases, registers and other sources



\*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers)

\*\*If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

**Table 1: Summary of included papers**

Journal Pre-proofs

| Author, Year, Country                            | Aim Study Design  | Population Data collection   | Intervention vs Comparator                             | Patient outcomes measured   | Family outcomes measured   | Provider outcomes measured              |
|--|---|--|--|---|--|---|
| <b>Randomised controlled trials (n=2)</b>        |   |  |  |   |  |   |
| Celik et al. 2019 Turkey **                      | Investigated influence of family presence during ED resuscitation on family & provider anxiety<br>Prospective randomized-controlled, open-label, single centre, interventional study                        | Family members of patients admitted to ED resuscitation room (n=100) | Family presence vs family absence during resuscitation | None  | Anxiety – State and Trait immediately post event                         | Anxiety                                 |
| Jabre et al. 2013 France ##                      | Compare systematic offer for relatives to witness resuscitation with traditional family care practices during OOHCA<br>Prospective, cluster randomised, controlled trial involving 15 prehospital EMS units | Adult OOHCA (n=630)  | Family presence vs family absence during resuscitation | ROSC<br>Survival to hospital admission<br>Survival at 28 days<br>Resuscitation procedures and duration                          | PTSD<br>Anxiety & depression symptoms<br>Behaviours during resuscitation | Emotional stress<br>Medico-legal claims |
| <b>Quantitative non-randomised studies (n=8)</b> |   |  |  |   |  |   |
| Waldemar et al. 2021 Sweden                      | Investigate associations between family-witnessed resuscitation and the outcomes of resuscitation.<br>Retrospective cohort study  | Adults with IHCA (n=3257)  | Family presence vs family absence during resuscitation | ROSC<br>Survival<br>Resuscitation duration<br>Termination of resuscitation  | None   | Family presence during resuscitation    |
| Wang et al. 2019 Taiwan                          | Explore association between family presence and provider resuscitation termination decisions during IHCA<br>Retrospective cohort study  | Patients with IHCA (n=1525)  | Family presence vs family absence during resuscitation | Family presence during resuscitation<br>ROSC<br>Resuscitation duration<br>Termination of resuscitation                          |  | None                                    |
| Soleimanpour et al. 2017 Iran                    | Compare presence and absence of psychological support to relatives during IHCA<br>Quasi-experimental study  | Adults with IHCA (n=133)   | Family presence vs family absence during resuscitation | Survival  | PTSD<br>Depression<br>Anxiety  | None                                    |
| Krochmal et al. 2017 USA                         | Study association between family presence during ICU resuscitation & patient outcomes<br>Retrospective cohort study   | Patients IHCA during first ICU admission (n=323)                     | Family presence vs family absence during resuscitation | ROSC<br>Survival to hospital discharge<br>Changes in resuscitation status<br>Subsequent resuscitation<br>Resuscitation duration |  | None                                    |

|  |  |  |  |          |  |                                 |  |
|--|--|--|--|----------|--|---------------------------------|--|
| Compton et al. 2011 USA                | Compare markers of adverse bereavement outcomes among family members who did and did not witness ED resuscitation<br>Prospective, quasi-experimental comparative | Adult family members (>18 years) of adults who received resuscitation in the ED  | Family presence vs family absence during resuscitation | None     |  | Symptoms of depression and PTSD | None   |
| Journal Pre-proofs                     |  |  |  |          |  |                                 |  |
| Compton et al. 2009 USA                | Assess PTSD symptoms associated with family members witnessing unsuccessful resuscitation during OOHCA<br>Prospective, observational cohort study                | Adult next-of-kin (>18 years) of adults with OOHCA who received resuscitation, were transported to ED, but died (n=54) | Family presence vs family absence during resuscitation | None     |  | PTSD                            | None   |
| Boyd & White, 2000 United Kingdom      | Determine whether family presence during resuscitation alters ED provider stress<br>Prospective cohort study   | ED staff (doctors, nurses & HCAs) participating in IHCA in ED (n=114)  | Family presence vs family absence during resuscitation | None     |  | None                            | Stress   |
| Post 1986 Country not reported         | Gather impressions from family members and attitudes of providers present during ED resuscitation<br>Descriptive, exploratory study                              | Family members of adults who underwent resuscitation in ED (n=47)  | Family presence<br>None                                | None     |  | Experience                      | Experience of family presence during resuscitation                     |
| Quantitative descriptive studies (n=8) |  |  |  |          |  |                                 |  |
| Magowan & Melby 2019 Ireland           | Identify views and experiences of ED providers of family presence during ED resuscitation<br>Cross-sectional, descriptive, correlational study                   | ED doctors, nurses and HCAs (=84)  | Family presence during resuscitation vs no comparator  | None     |  | None                            | Views and experiences  |
| Metzger et al. 2019 Switzerland and    | Assess prevalence of depression and anxiety symptoms among relatives of OOHCA patients 90 days after the event<br>Prospective observational cohort study         | Patients admitted to ICU following OOHCA (n=101)   | Family presence during resuscitation vs no comparator  | Survival |  | Depression and anxiety          | None   |
| Sak-Dankosky et al. 2015 USA           | Examine factors associated with providers' experiences and attitudes towards family-witnessed resuscitation in ED & ICU<br>Descriptive, exploratory study        | Finnish and Polish Registered Nurses and physicians (n=390)  | Family presence during resuscitation vs no comparator  | None     |  | None                            | Experiences and attitudes towards adult family-witnessed resuscitation |

|                                    |  |   |   |          |            |  |
|------------------------------------|--|---|---|----------|------------|--|
| Ganz et al. 2012 Israel            | Determine attitudes of nurses toward family presence during resuscitation<br>Correlational, descriptive study  | ICU and cardiovascular registered nurses from two hospitals (n=93)                                | Family presence during resuscitation vs no comparator | None     | None       | Attitudes toward family presence during resuscitation  |
| Journal Pre-proofs                 |  |   |   |          |            |  |
| n et al. 2010 Europe               | nurses' experiences of and attitudes towards family presence during resuscitation in IHCA<br>Descriptive study   | from four cardiovascular nursing conferences (Norway, Sweden, Ireland & UK)                       | presence during resuscitation vs no comparator        |          |            | & attitudes  |
| Oman et al. 2010 USA               | Evaluate frequency, & provider experience, of family presence during resuscitation in IHCA<br>Descriptive study  | Adults with IHCA (n=31)   | Family presence during resuscitation vs no comparator | ROSC     | None       | Experience of family presence during resuscitation   |
| Badir & Sepit 2007 Turkey          | Determine experiences and opinions of Turkish critical care nurses about family presence during resuscitation in IHCA<br>Descriptive study   | Critical care nurses (n=278)  | Family presence during resuscitation vs no comparator | None     | None       | Experience   |
| Belanger & Reed, 1997 USA          | Family and resuscitation team members' perceptions of family presence during resuscitation<br>Descriptive study  | Family members of patients present during resuscitation in ED (n=24)                              | Family presence during resuscitation vs no comparator | None     | Experience | Experience   |
| <b>Mixed methods studies (n=1)</b> |  |   |   |          |            |  |
| Meyers et al. 2000 USA **          | Determine family members and provider attitudes about family presence during resuscitation in IHCA**<br>Descriptive mixed methods study  | Adults with IHCA (n=19)   | Family presence during resuscitation vs no comparator | Survival | Attitudes  | Attitudes, perceived problems and benefits   |
| <b>Qualitative studies (n=12)</b>  |  |   |   |          |            |  |
| Giles et al. 2018 Australia        | Examine how providers practise principles of beneficence when deciding to allow or deny family presence during resuscitation<br>Qualitative study  | Health professionals who performed resuscitation in the direct/indirect presence of family (n=20) | Family presence during resuscitation vs no comparator | None     | None       | Providers' practise of principles of beneficence   |
| Hassankhani et al. 2017A Iran      | Illuminate the meaning of lived experiences of resuscitation providers with family presence during resuscitation in the cultural context of Iran<br>Qualitative (interpretive phenomenology) | Medical (n=9) and nursing staff (n=12) from ED, ICU or CCU resuscitation teams                    | Family presence during resuscitation vs no comparator | None     | None       | Meaning of the lived experience of family presence during resuscitation within Iran's cultural context |

|                                    |  |   |  |   |  |   |
|------------------------------------|--|---|--|---|--|---|
| Hassankhani et al. 2017B Iran      | Explore lived experience of providers of family presence during resuscitation in ED & critical care units<br>Qualitative (hermeneutic phenomenology)                 | Medical (n=8) and nursing staff (n=12) from n ED, ICU or CCU resuscitation                          | Family presence during resuscitation vs no comparator  | None                                      | None   | Lived experience of, and attitudes towards, family presence   |
| Journal Pre-proofs                 |  |   |  |   |  |   |
| DeStefano et al. 2016 France       | Characterise experience of family members offered the choice of observing resuscitation during OOHCA<br>Qualitative component of a randomised multicenter trial      | Family members of adults who experienced OOHCA at home (n=30) resuscitation event                   | Family presence vs family absence during resuscitation | None                                      | Experience   | None  |
| Giles et al. 2016 Australia        | Examine factors impacting family presence during resuscitation in IHCA<br>Qualitative (constructivist grounded theory)   | Health professionals who had performed resuscitation in the direct/indirect presence of family      | Family presence during resuscitation vs no comparator  | Examine factors impacting family presence | Examine factors impacting family presence                        | Examine factors impacting family presence                     |
| Masa' Deh et al. 2014 Jordan       | Explore family members' needs during resuscitation in adult critical care settings & effect of cultural and religious issues on family presence<br>Qualitative study | Patients with IHCA (n=7)  | Family presence vs family absence during resuscitation | ROSC                                      | Family member's needs<br>Effect of cultural and religious issues | None  |
| Walker et al. 2014 United Kingdom  | Explore lived experience of lay persons' presence during resuscitation in OOHCA and IHCA<br>Qualitative (hermeneutical phenomenology)                                | Ambulance Service officers (n=8) & RNs (n=10)   | Family presence during resuscitation vs no comparator  | None                                      | None   | Lived experience of out-of-hospital and in-hospital providers |
| Monks & Flynn, 2014 United Kingdom | Gain insights into nurses' experience of family witnessed resuscitation during IHCA<br>Qualitative exploratory study (phenomenology)                                 | Nurses who had been involved in a family witnessed adult resuscitation in critical care areas (n=6) | Family presence during resuscitation vs no comparator  | None                                      | None   | Experience of family presence during resuscitation            |
| Bremer et al. 2012 Sweden          | Analyse EMS personnels' experiences of caring for families during OOHCA & sudden death<br>Qualitative study (hermeneutics)   | EMS personnel (n=10)  | Family presence during resuscitation vs no comparator  | None                                      | None   | Experiences   |
| Weslien et al. 2006 Sweden         | Illuminate family members' experiences and views about being present during ED resuscitation<br>Qualitative study  | Adults ( $\geq 18$ years) with resuscitation in the ED (n=17)                                       | Family presence vs escorted to a private room          | Survival                                  | Experience   | None  |

|                        |   |  |   |          |  |      |
|------------------------|---|--|---|----------|--|------|
| Wagner et al. 2004 USA | Describe experiences, thoughts, and perceptions of family members during ICU resuscitation<br>Qualitative study | Adults (>18 years) with IHCA in ICU and who survived (n=6) | Family presence during resuscitation vs no comparator | Survival | Experience , thoughts, and perceptions | None |
| Van der                | Provide essence of long   | Volunteers   | Family  | None     | Lived                                  | None |
| 1999 United Kingdom    | resuscitation of a relative during 'resuscitation' Qualitative study (hermeneutical phenomenology)              | witnessed resuscitation of an adult relative (n=5)         | during resuscitation vs no comparator                 |          |  |      |

CCU = coronary care unit; ED = emergency department; EMS = emergency medical service; IHCA = in-hospital cardiac arrest; HCA = health care assistant; OOHCA = out-of-hospital cardiac arrest; OR = odds ratio; PTSD = post-traumatic stress disorder; ROSC = return of spontaneous circulation; USA = United States of America

*##this study examined offering relatives a choice to witness resuscitation with traditional family care practices during OOHCA: of the 266 relatives in the intervention group, 211/266 witnessed and 55/266 did not witness resuscitation and of the 204 control group relatives 131/304 witnessed and 173/307 did not witness resuscitation. Given there were families present and absent in the intervention and control groups, data related to family presence versus absence during resuscitation is presented in preference to intervention versus control groups*

*\*\* these studies examined family presence during resuscitation and invasive procedures: only data related to resuscitation is presented*

## APPENDIX 1: SEARCH STRATEGY

Search date: 10 May 2022 (all data bases)

### Limiters

- human studies
- adults
- published in languages other than English without an English abstract

| MEDLINE |   |           |
|---------|---|-----------|
|         | Search term   | Citations |
| S12     | 5 or 9 or 11  | 1648      |
| S11     | 3 and 10  | 767       |
| S10     | ((family or families or "next of kin*" or relatives or significant other* or spouse* or husband* or wife or wives or partner* or parent* or sibling* or friend* or companion* or children or grandparent* or grandmother* or grandfather* or mother* or father* or brother* or sister* or son or sons or daughter*) adj3 (presence or present or attend* or observ* or witness* or perception* or participat* or visit*)).mp. | 109326    |
| S9      | 3 and 8   | 270       |
| S8      | 6 or 7  | 24670     |
| S7      | (visit* adj2 patient*).mp.  | 24670     |
| S6      | Visitors to Patients/   | 2263      |
| S5      | 3 and 4   | 1254      |
| S4      | family/ or adult children/ or grandparents/ or nuclear family/ or parents/ or fathers/ or mothers/ or single parent/ or siblings/ or spouses/   | 232672    |

|    |  |       |
|----|--|-------|
| S3 | 1 or 2   | 78266 |
| S2 | (cpr or cardiopulmonary resus* or chest compression* or (bls or basic life support) or first aid or aed).mp. | 51906 |
| S1 | first aid/ or resuscitation/ or cardiopulmonary resuscitation/ or heart massage/ or Defibrillators/          | 57306 |

Journal Pre-proofs

| CINAHL |  |           |
|--------|--|-----------|
|        | Search term  | Citations |
| S20    | S17 OR S18 OR S19  | 3747      |
| S19    | S4 AND S15   | 578       |
| S18    | S4 AND S8  | 3746      |
| S17    | S4 AND S16   | 1729      |
| S16    | S8 AND S14   | 397409    |
| S15    | ((family or families or "next of kin*" or relatives or significant other* or spouse* or husband* or wife or wives or partner* or parent* or sibling* or friend* or companion* or children or grandparent* or grandmother* or grandfather* or mother* or father* or brother* or sister* or son or sons or daughter*)<br>N3 (presence or present or attend* or observ* or witness* or perception* or participat* or visit*)) | 72372     |
| S14    | S9 OR S10 OR S11 OR S12 OR S13   | 1649041   |
| S13    | AB (presen* or attend* or observ* or witness* or participat*)  | 1572024   |
| S12    | TI (presen* or attend* or observ* or witness* or participat*)  | 135386    |
| S11    | AB (visit* N2 patient*)  | 11849     |
| S10    | TI (visit* N2 patient*)  | 1069      |
| S9     | (MP visitors to patients)  | 7444      |
| S8     | S5 OR S6 OR S7   | 1193122   |
| S7     | AB (famil* or "next of kin*" or kinship or relativ* or "significant other*" or spouse* or husband* or wife* or partner* or parent* or sibling* or friend* or companion* or child* or carer* or grandparent* or mother* or father* or brother* or sister*)  | 959238    |
| S6     | TI (famil* or "next of kin*" or kinship or relativ* or "significant other*" or spouse* or husband* or wife* or partner* or parent* or sibling* or friend* or companion* or child* or carer* or grandparent* or mother* or father* or brother* or sister*)  | 511560    |
| S5     | (MH Family) or (MH Extended Family) or (MH Family Relations) or (MH Nuclear Family) or (MH Siblings) or (MH Grandparents) or (MH Parents)  | 117537    |
| S4     | S1 OR S2 OR S3   | 23265     |
| S3     | AB (cpr or cardiopulmonary resus* or chest compression*)   | 8923      |
| S2     | TI (cpr or cardiopulmonary resus* or chest compression*)   | 7166      |
| S1     | MH (Cardiopulmonary Resuscitation or resuscitation or Defibrillators)  | 11352     |



| EMBASE             |  |           |
|--------------------|--|-----------|
|                    | Search term  | Citations |
| S20                | 13 or 17 or 19   | 5829      |
| S19                | 7 and 18   | 1298      |
| S18                | ((family or families or "next of kin*" or relatives or significant other* or   | 98682     |
| Journal Pre-proofs |  |           |
|                    | or friend* or companion* or children or grandparent* or grandmother* or grandfather* or mother* or father* or brother* or sister* or son or sons or daughter*) adj2 (presence or present or attend* or observ* or witness* or perception* or participat* or visit*)).mp. |           |
| S17                | 7 and 16   | 552       |
| S16                | 14 or 15   | 42535     |
| S15                | (visit* adj2 patient*).mp.   | 42535     |
| S14                | exp patient visitor/   | 479       |
| S13                | 7 and 12   | 4613      |
| S12                | 8 or 9 or 10 or 11   | 421671    |
| S11                | sibling/ or exp brother/ or exp sister/  | 50211     |
| S10                | exp spouse/  | 22297     |
| S9                 | parent/ or exp father/ or exp mother/ or exp single parent/  | 262260    |
| S8                 | family/ or exp 'adult child'/ or exp grandchild/ or exp grandparent/ or exp 'nuclear family'/  | 421671    |
| S7                 | 1 or 2 or 3 or 4 or 5 or 6   | 224964    |
| S6                 | (cpr or cardiopulmonary resus* or chest compression* or (bls or basic life support) or first aid or aed).mp.   | 68874     |
| S5                 | exp basic life support/  | 539       |
| S4                 | exp defibrillator/   | 71219     |
| S3                 | exp heart massage/   | 2344      |
| S2                 | exp first aid/   | 9943      |
| S1                 | exp resuscitation/   | 122488    |