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**Winter, 2013**

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CHAD KLOCHKO, MS

Dear Readers,

The year 2013 is going to be a very exciting year for the *Medical Student Research Journal* (MSRJ). MSRJ has made great strides in the past 12 months and can look forward to a bright future in the year ahead. We have more than tripled our editorial staff, which now consists of 12 second- through fourth-year medical students. Our current efforts to recruit first-year students looks like it will almost double our staff size, getting our editorial board to around 20 students. By the end of 2013, we aim to have a 30-member editorial board.

In the past months, with the assistance of a graphic designer, our layouts and logo have undergone a 'facelift', providing the journal with a professional look going forward. A new MSRJ website, which will hopefully help to streamline the editing process and enable us to review papers more efficiently and with greater accuracy, is under development.

It is with great pleasure we announce that MSRJ is joining hands with four other international student journals in creating the International Medical Student Journalism Award. The MSRJ in addition to the *Scottish Universities Medical Journal*, *Res Medico*, *Trinity Medical Student Journal* and the *Journal of the Asian Medical Student Association* will submit one article each from their yearly publications. The articles will be evaluated by a panel of independent judges. To be considered for this award, one's article needs to be published in any of the aforementioned journals.

We always have opportunities for new student reviewers. The MSRJ has an online reviewer training protocol which enables any currently enrolled medical student, anywhere in the world, to act as a reviewer for us. If you are interested in being a reviewer with us, please visit [www.msrb.org/reviewers](http://www.msrb.org/reviewers).

Thank you for reading, and we wish you all the very best in 2013. Our next issue is expected in May 2013, and we are currently accepting papers for the same. If you wish to contribute, please visit [www.msrb.org](http://www.msrb.org) and follow the submission instructions.

All the best,



Chad Klochko, M.S.  
Executive Editor, MSRJ 2012–2013



David Ortiz  
Executive Editor, MSRJ 2012–2013



## The color of medicine

Diana Salinas

College of Human Medicine, Michigan State University

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*I will not permit considerations of religion, nationality, race, gender, politics, socioeconomic standing, or sexual orientation to intervene between my duty and my patient.*

**T**his bullet point from the physician's oath is engraved around the margins to remind us that as physicians we should treat and care for each patient equally and in an unbiased manner, but at the same time understand that a universal treatment plan will not apply to all patients. This requires us as physicians to develop cultural competency and be aware of patient diversity.

The symbol of medicine in the center represents the power granted to us as physicians. However, we have to be careful not to abuse that power. Instead, we have to do our best to meet eye to eye with our patients to encourage communication and develop a shared treatment plan. Therefore, the symbol of medicine stands out, but if we remove the margin, all the colors blend because, at the end of the day, despite our role as physicians, we are still people who can get sick and make mistakes.

Medicine is about teamwork. We bring our own unique experiences to the field, and we need to work together regardless of our title or specialty choice. This includes other healthcare professionals and support staff. To represent this, the symbol of medicine is composed of different colors to showcase the variety of careers that encompass the field of medicine.

# The role of ultrasound screening in reducing AAA mortality: a review

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**Background:** Men aged 65–79 are at the highest risk of having an abdominal aortic aneurysm (AAA) as well as a high incidence of rupture; this is treated as a surgical emergency, which has a total mortality of 75–90%.<sup>1–5</sup> The diameter of an AAA proves to be the most useful risk factor in predicting mortality rates.<sup>6,7</sup> Ultrasonography is widely accepted as an effective diagnostic imaging tool for detecting AAA.<sup>8</sup> Based on this, AAA elective repair is recommended to individuals with AAA of diameter  $\geq 55$  mm.<sup>6,7</sup> The problem lies in detecting individuals with AAA as many are asymptomatic.<sup>9</sup> The aim of this article is to determine whether a population-based ultrasound screening programme can significantly reduce AAA mortality using the critical appraisal skills programme (CASP) tool.

**Method:** Databases were searched for relevant literature. Studies were limited to randomised controlled trials (RCTs) that conducted a population-based screening programme using ultrasound. The results were further refined using inclusion and exclusion criteria. Four RCTs were selected for review.

**Results:** The pooled results of 125,576 men showed a significant reduction in the incidence of ruptured AAAs and AAA-related mortality in the intervention group. There was an insignificant reduction in all-cause mortality, and a significant increase in surgical rates in the intervention group. One of the reviewed studies looked at the effects of screening on 9,342 women and reported an insignificant reduction in AAA-related mortalities, all-cause mortality, and ruptured incidence.

**Conclusion:** There is evidence that a population-based screening has a significant effect in reducing AAA-related mortality in males aged 65–74. Due to the paucity of evidence in current available literature, no definitive conclusions can be drawn regarding population-based screening for AAA in women; it is suggested that future studies should be carried out to assess the benefits and relative risks of screening for this population.

**Keywords:** population; screening; ultrasonography; abdominal aortic aneurysms; mortality; systematic review.

## INTRODUCTION

An abdominal aortic aneurysm (AAA) occurs when there is a weakness in the arterial wall that leads to a dilatation of the aorta.<sup>1</sup> The most common cause of AAA is due to arteriosclerosis, but it can also be caused by other means, such as trauma and infectious diseases.<sup>1</sup> The majority of AAAs or AAA-related deaths occur in men aged 65–79 and account for a total mortality of 0.5%.<sup>2–4</sup> The prevalence of AAA in this age group is 4–8% for men and 0.5–1.5% for women.<sup>10–13</sup> AAA contributes significantly to the total mortality rate in developed countries such as the United States and the United Kingdom, where there are 13,000 deaths and 6,000 deaths per annum, respectively;<sup>14,15</sup> 60% are AAA-related and the remainder are due to thoracic aortic aneurysms.<sup>15,16</sup> Significant risk factors, such as age, gender, smoking, family history, and atherosclerotic disease, are known to contribute to the development of AAA.<sup>10</sup>

AAAs are generally asymptomatic for many years, but the area of weakness present in the aorta is prone to

rupture if left untreated and can lead to fatality due to a rapid loss of blood.<sup>9,17</sup> This major complication culminates in a large proportion of individuals dying before surgery or even before arriving at a hospital, therefore making this a surgical emergency.<sup>5,18</sup> The mortality rate for such a complication after emergency surgery is 75–90%; this gives it a poor prognosis when compared to those who undergo elective AAA surgery, which has a post-operative mortality rate of 3.3%.<sup>5,19,20</sup> Despite the increase in surgical elective repairs, there are still a number of further complications that could occur, such as operative mortality and renal failure;<sup>21,22</sup> these could be used to explain the continual rise of the age/sex standardised mortality from ruptured AAAs.<sup>23,24</sup> AAA rupture depends on the size of the aneurysm and can be anticipated by a preclinical detectable phase, which provides an opportunity for a relatively low-risk surgical treatment when compared to that of the symptomatic phase.<sup>25</sup> This poses the question of whether a screening programme is likely to be beneficial or not.

Screening programmes have to meet a standard set by the World Health Organisation (WHO) and the Council of Europe before their introduction.<sup>23</sup> In the United Kingdom, they are not implemented unless it has been approved by the National Screening Committee, which takes into consideration evidence from randomised control trials (RCTs).<sup>26</sup> Originally, the National Screening Committee believed that there was insufficient evidence on which to recommend a population-based screening programme,<sup>27</sup> but the Committee has now reconsidered their evaluation based on current evidence.<sup>8</sup> The National Health Service AAA screening programme is being implemented gradually across England, and full coverage is expected by March 2013.<sup>25</sup> This programme is aimed at men over 65 and measures the maximum diameter of the aorta during systole to determine whether an aneurysm is present or not.<sup>1</sup> However, in many other western countries, no population-based screening programmes exist; the only means of screening available to individuals is via referrals from their general practitioner.<sup>25</sup>

Detecting AAA can be carried out in a number of ways using diagnostic imaging tools such as angiography, computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound.<sup>1</sup> In this review, only ultrasound is considered as a means of screening because it is universally accepted as the most effective screening tool for AAA as well as being widely reported in the current available literature.<sup>8,28,29</sup> Ultrasonography is successful in detecting AAAs with an approximate sensitivity and specificity rate of 98% and 99%, respectively.<sup>19,30,31</sup> There has been a consistently high rate of attendance at programmes that range from 65% to 80%. Approximately 85–90% of aneurysms detected by screening are too small to warrant surgery; therefore, they are monitored under surveillance programmes that have a 95% attendance rate.<sup>23,24</sup> Treatment for asymptomatic patients has been established based on the evidence from two RCTs<sup>6,7</sup> that identified the most useful risk factor in predicting mortality as being the diameter of the AAA, quantifying a threshold of 55 mm or greater for a patient to be eligible for surgery.

The aim of this article is to determine whether a population-based ultrasound screening programme can significantly reduce AAA mortality using the critical appraisal skills programme (CASP) tool. This will be done by covering the following objectives:

- (1) Perform a search of relevant literature pertaining to AAA screening via ultrasound.
- (2) Use specific inclusion and exclusion criteria to refine the search method and acquire the evidence.
- (3) Draw conclusions by critically reviewing the evidence using CASP tools.

## METHOD

### Search method

A review on the precision of ultrasound was not necessary, as direct evidence was available regarding this. The topic, AAA, was searched via databases and search engines to identify RCTs that determine the significance of AAA population-based screening using ultrasound. These included the Cochrane database, the current controlled trials database, MetaLib provided by Lancaster University, PubMed and ScienceDirect.<sup>32</sup> These were further restricted with medical subject heading (MeSH) terms to narrow the results (Table 1).<sup>32</sup> Search methods employed were adapted to suit each database (Tables 2–5). Additional studies were further identified from the reference lists of articles that were relevant in the searches.

### Criteria for considering studies

Twenty-three relevant articles were initially retrieved before being subjected to inclusion and exclusion criteria (Table 6). This then gave rise to four RCTs that were chosen to be reviewed and critically appraised using CASP tools.<sup>33</sup>

### Quality of trials

CASP was developed in 1993 in response to critically appraising research.<sup>34</sup> It has helped form an evidence-based approach in the health care setting as well as providing a process in which research and evidence can be found and interpreted in an efficient and reliable fashion.<sup>34</sup> The CASP tool is a derivative from CASP and consists of a series of questions that acts as a guide to check against particular biases that are linked to specific study designs. Use of CASP tools allows articles to be systematically appraised to assess the methodological quality, reliability, validity and also the extent to which they can be used to draw conclusions.<sup>33</sup> Furthermore, assigning a scoring system to the CASP tool will allow similar studies to be scored in a similar fashion; doing so enables comparisons to be made as well as assessing any heterogeneity present. The studies selected will be subjected to the CASP tool relevant to RCTs.

## RESULTS

Four RCTs that evaluated population-based screenings met the criteria from Table 6 and were reviewed – Chichester,<sup>35</sup> MASS,<sup>36</sup> Western Australia<sup>37</sup> and Viborg.<sup>38</sup>

**Table 1.** MeSH terms.

MeSH term
Abdominal aortic aneurysms
Ultrasonography
Mass screening

**Table 2.** Results for Cochrane database.

Search history	Number of results
1. Abdominal aortic aneurysms	29
2. Ultrasonography	62
3. Mass screening	30
4. 1+2+3	6
5. Rupture	128
6. 4+5	4

**Table 3.** Results for current controlled trials database.

Search history	Number of results
1. Abdominal aortic aneurysms	28
2. Ultrasonography	334
3. Mass screening	10
4. 1+2+3	0
5. 1+2	2
6. 1+3	10

**Table 4.** Results for PubMed.

Search history	Number of results
1. Abdominal aortic aneurysms	11,002
2. Ultrasonography	210,710
3. Mass screening	84,486
4. 1+2+3	42
5. Rupture	31,311
6. 4+5	10

**Table 5.** Results for ScienceDirect.

Search history	Number of results
1. Abdominal aortic aneurysms	27,933
2. Ultrasonography	90,585
3. Mass screening	203,182
4. 1+2+3	994
5. Rupture	234,364
6. 4+5	634
7. 6+Randomised control trials	124
8. Limits were applied – 'English'	30

The characteristics, mortality caused by AAA, overall mortality, incidence of rupture and surgery for AAA of these studies are recorded in Tables 7–11. The studies were then critically appraised using CASP tools in Table 12 (taken directly from the Public Health Resource Unit).<sup>33</sup>

### Description of the studies

The Chichester study<sup>35</sup> identified 6,433 men and 9,342 women aged 65–80 to participate; MASS<sup>36</sup> – 67,800 men aged 65–74; Western Australia<sup>36</sup> – 41,000 men

**Table 6.** Inclusion and exclusion criteria.

Types of studies	
Inclusion criteria	<ol style="list-style-type: none"> <li>1. All RCTs that directly compared ultrasound screening to no screening</li> <li>2. Follow-up period that is <math>\geq 2</math> years for adequate analysis</li> <li>3. Articles that pertain to the English language and available in full</li> <li>4. Studies from 1991 to 2011</li> </ol>
Exclusion criteria	<ol style="list-style-type: none"> <li>1. Studies that are not RCTs</li> </ol>
Types of participants	
Inclusion criteria	<ol style="list-style-type: none"> <li>1. Trials, including patients that are symptomatic or asymptomatic for AAA</li> <li>2. Trials from any population</li> <li>3. Both sexes</li> </ol>
Exclusion criteria	–
Types of interventions	<ol style="list-style-type: none"> <li>1. Ultrasound screening preferred (screening alone was to be considered as long as there was sufficient data for the outcomes)</li> </ol>
Types of outcome measures	
Outcome	<ol style="list-style-type: none"> <li>1. Mortality</li> <li>2. Incidence of rupture</li> <li>3. Surgery required</li> <li>4. Life expectancy</li> </ol>

aged 65–79; and Viborg<sup>38</sup> – 12,658 men aged 65–73. In Chichester and MASS, participants were randomly selected from practice registers and health service lists in the United Kingdom.<sup>35,36</sup> Participants for the Western Australia study were selected from the electoral roll in Perth, Australia, and Viborg participants were randomly selected from the health department in Viborg, Denmark.<sup>37,38</sup> In all four studies, randomisation was computer generated.<sup>35–38</sup> Participants were offered screening or a no-intervention control group for AAA on a 1:1 ratio; participants of the control group were followed with no contact throughout the study. Three of the studies established randomisation in groups to avoid a time lapse between randomisation and screening.<sup>35,36,38</sup> The Western Australia screening sessions were carried out over a 32-month period for logistical reasons.<sup>37</sup> This meant that men were not invited to the screening programme until a few months had passed, and as a result, 2,296 died before being screened.<sup>37</sup> Participants for the Chichester and MASS studies were excluded prior to randomisation, if they resided in a nursing home or if their general practitioner declared they were not in a suitable condition for elective AAA repair.<sup>35,36</sup> Similarly, the Western Australia study excluded individuals residing in a nursing home as well as those who resided too far to access a screening



**Table 7.** Characteristics of each study.

Characteristics of study	Chichester study – men <sup>34</sup>	Chichester study – women <sup>34</sup>	MASS <sup>35</sup>	Western Australia study <sup>36</sup>	Viborg county study <sup>37</sup>
Location	UK	UK	UK	Australia	Denmark
Age (years)	65–80	65–80	65–74	65–83	65–73
Participants (n)	6,433	9,342	67,800	38,704	12,658
Mean follow-up (years)	2.5	2.6	4.1	3.6	5.1
Randomised to screening (n)	3,205	4682	33,839	19,352	6,339
Screening attendance (%)	73.0	65.0	80.0	70.0	76.0
Randomised to no screening (n)	3,228	4,660	3,3961	19,352	6,319

clinic.<sup>37</sup> No exclusions were noted for the Viborg study. Screening sessions were carried out at general practitioners for three of the studies.<sup>35–37</sup> The Viborg study carried out screening in the county hospitals via a mobile screening team.<sup>38</sup> All four studies used abdominal ultrasound as the screening method, and none were blinded due to their nature.<sup>35–38</sup> An AAA was defined as having a diameter that was  $\geq 30$ mm.<sup>35–38</sup> The outcome measures for all four studies were the number of identified surgeries that took place;<sup>35–38</sup> Chichester also identified the incidence of ruptured aneurysms.<sup>35</sup>

*Study 1<sup>35</sup> – Influence of screening on the incidence of ruptured abdominal aortic aneurysm: 5-year results of a randomised controlled study (Chichester)*

The acceptance rate was higher for men when compared to women (73.0% and 65.0% respectively).<sup>35</sup> This declined with age; men and women aged 65 had a rate of 80.4% and 72.6%, respectively, and men and women aged 76–80 had an acceptance rate of 66.1% and 58.2%, respectively.<sup>35</sup> The indication for surgery in this study was that the AAA had an annual growth rate that was  $\geq 10$ mm or if the maximum diameter measured was  $\geq 60$ mm. Ongoing surveillance was recorded; patients with aneurysms of 30–44 mm were rescanned on an annual basis and aneurysms of 45–59 mm were scanned quarterly.<sup>35</sup> There was a significant increase in elective surgeries performed, odds ratio (OR) – 2.42;

95% confidence interval (CI) – [1.26–4.62] and the average follow-up was 2.5 years.<sup>35</sup> There was independent classification of deaths that were thought to be AAA related.<sup>35</sup> The mortality rate from AAA was regarded as not significant in the intervention group, OR – 0.59; 95% CI – [0.27–1.29]. The overall mortality rates were regarded as not significant, OR – 1.07; 95% CI – [0.93–1.22]. Fewer ruptured aneurysms were seen in the screened group, OR – 0.45; 95% CI – [0.21–0.99]. Women were analysed separately from men to assure homogeneity was achieved in the results, but no benefit was seen; AAA-related mortality – OR – 1.99; 95% CI – [0.36–10.88]; all-cause mortality, OR – 1.06; 95% CI – [0.93–1.21]; and ruptured incidence, OR – 1.49; 95% CI – [0.25–8.94]. Full results are available in Tables 8–11.

*Study 2<sup>36</sup> – The multi-centre aneurysm screening study (MASS) into the effect of abdominal aortic aneurysm screening on mortality in men: a randomised controlled trial (MASS)*

There was an acceptance rate of 80.0%.<sup>36</sup> Referrals were issued if the aneurysm was  $\geq 55$ mm or growing at a rate  $\geq 10$ mm per year. Surveillance was carried out annually, if the aneurysm was 30–44 mm and quarterly if it was 44–54 mm.<sup>36</sup> Thirty-one of the three hundred and twenty-two patients who had surgery did not meet the criteria for elective AAA surgery.<sup>36</sup> There was a

**Table 8.** Mortality caused by AAA.

AAA Mortality – study	Patients screened (n/N)	Patients unscreened (n/N)	Weight (%)	Odds ratio (95% confidence interval)
Chichester – men <sup>34</sup>	10/3,205	17/3,228	10.0	0.59 [0.27–1.29]
MASS <sup>35</sup>	65/33,839	113/33,961	65.9	0.58 [0.42–0.78]
Western Australia <sup>36</sup>	18/19,352	25/19,352	16.8	0.72 [0.39–1.32]
Viborg County <sup>37</sup>	6/6,339	19/6,319	7.3	0.31 [0.13–0.79]
Total – men	99/62,735	174/62,860	100	0.57 [0.45–0.74]
Total – excluding Viborg County	93/56,396	135/56,541	–	0.60 [0.47–0.78]
Total – excluding MASS – sensitivity analysis	28/28,896	61/28,899	–	0.56 [0.36–0.88]
Chichester – women <sup>34</sup>	4/4,682	2/4,660	100	1.99 [0.36–10.88]
Total – women	4/4,682	2/4,660	100	1.99 [0.36–10.88]

**Table 9.** Overall mortality.

Overall mortality – study	Patients screened (n/N)	Patients unscreened (n/N)	Weight (%)	Odds ratio (95% confidence interval)
Chichester – men <sup>34</sup>	532/3,205	508/3,228	7.8	1.07 [0.93–1.22]
MASS <sup>35</sup>	3,750/33,839	3,855/ 33,961	60.2	0.97 [0.93–1.02]
Western Australia <sup>36</sup>	2,232/19,352	2,571/19,352	32.0	0.85 [0.80–0.90]
Viborg County <sup>37</sup>	N/A	N/A	N/A	N/A
Total – men	6,514/62,735	6,934/62,860	100	0.95 [0.85–1.07]
Chichester – women <sup>34</sup>	503/4,682	476/4,660	100	1.06 [0.93–1.21]
Total – women	503/4,682	476/4,660	100	1.06 [0.93–1.21]

significant increase in elective surgeries performed, OR – 2.45; 95% CI – [2.02–2.97], and the average follow-up was 4.1 years.<sup>36</sup> Cause of death was noted by death certificate only.<sup>36</sup> The mortality rate from AAA was regarded as significant, with a strong reduction in the intervention group, OR – 0.58; 95% CI – [0.42–0.78]. The overall mortality rates were regarded as not significant, OR – 0.97; 95% CI – [0.93–1.02]. Full results are available in Tables 8–11.

*Study 3<sup>37</sup> – Population-based randomised controlled trial on impact of screening on mortality from abdominal aortic aneurysm (Western Australia)*

There was an acceptance rate of 70.0%.<sup>37</sup> Surgery indications were left to individual surgeons to decide. A suggested surveillance programme was sent via letter to individuals recommending annual screening, if their aneurysm was 30–39mm, and twice annually, if it was 40–49mm.<sup>37</sup> Referrals for surgery with aneurysms that were ≥45mm were left up to discretion of the physician.<sup>37</sup> A vascular referral was issued, if the aneurysm was ≥50mm.<sup>37</sup> No other means of contact were carried out by the investigators for either group. There was a significant increase in elective surgeries performed, OR – 1.88; 95% CI – [1.38–2.56], and the average follow-up was 3.6 years.<sup>37</sup> There was independent classification of deaths that were thought to be AAA related.<sup>37</sup> The mortality rate from AAA was regarded as not significant in the intervention group, OR – 0.72; 95% CI – [0.39–1.32]. The overall mortality

rates were regarded as significant but are only reported from the point of screening, not randomisation, OR – 0.85; 95% CI – [0.80–0.90]. Full results are available in Tables 8–11.

*Study 4<sup>38</sup> – Hospital costs and benefits of screening for abdominal aortic aneurysms. Results from a randomised population screening trial (Viborg)*

There was an acceptance rate of 76.0%.<sup>38</sup> Referrals were issued, if the aneurysm was ≥55mm.<sup>38</sup> Surveillance was carried out annually, if the aneurysm was ≥30mm.<sup>38</sup> There was a non-significant increase in elective surgeries performed, OR – 1.46; 95% CI – [0.98–2.18], and the average follow-up was 5.1 years.<sup>38</sup> The mortality rate from AAA was regarded as significant, with a strong reduction in the intervention group, OR – 0.31; 95% CI – [0.13–0.79]. As this study only identified deaths that occurred within the hospital setting, it cannot be compared to the other studies. There was insufficient data to calculate overall mortality rates. Full results are available in Tables 8–11.

#### META-ANALYSIS OF STUDIES

The meta analyses of the results are available in Tables 8–11. Overall, the combined number of participants totaled at 125,576 men, with an attendance rate ranging from 70% to 80%. The pooled odds ratio and confidence interval (excluding the Viborg study due to reliability of results – OR – 0.60; 95% CI – [0.47–0.78]) supported the use of ultrasound screening for AAA, as it showed a

**Table 10.** Incidence of ruptured AAA.

Incidence of rupture – study	Patients screened (n/N)	Patients unscreened (n/N)	Weight (%)	Odds ratio (95% confidence interval)
Chichester – men <sup>34</sup>	9/3,205	20/3,228	100	0.45 [0.21–0.99]
MASS <sup>35</sup>	N/A	N/A	N/A	N/A
Western Australia <sup>36</sup>	N/A	N/A	N/A	N/A
Viborg County <sup>37</sup>	N/A	N/A	N/A	N/A
Total – men	9/3,205	20/3,228	100	0.45 [0.21–0.99]
Chichester – women <sup>34</sup>	3/4,682	2/4,660	100	1.49 [0.25–8.94]
Total – women	3/4,682	2/4,660	100	1.49 [0.25–8.94]

**Table 11.** Surgery for AAA.

Surgery for AAA – study	Patients screened (n/N)	Patients unscreened (n/N)	Weight (%)	Odds ratio (95% confidence interval)
Chichester – men <sup>34</sup>	31/3,205	13/3,228	11.2	2.42 [1.26–4.62]
MASS <sup>35</sup>	354/33,839	146/33,961	38.8	2.45 [2.02–2.97]
Western Australia <sup>36</sup>	116/19,352	62/19,352	28.3	1.88 [1.38–2.56]
Viborg County <sup>37</sup>	60/6,339	41/6,319	21.8	1.46 [0.98–2.18]
Total – men	561/62,735	262/62,860	100	2.03 [1.59–2.59]

reduction in AAA-related mortalities, OR – 0.57; 95% CI – [0.45–0.74]. The MASS had the largest weight in the pooled results with the narrowest CI. Sensitivity analysis revealed that when the MASS results were removed, the other three studies still showed a significant reduction in AAA mortalities, OR – 0.56; 95% CI – [0.36–0.88]. The all-cause mortality results were unavailable for the Viborg study, so the Chichester, MASS and Western Australia studies were pooled. They showed that screening was not significant in reducing all-cause mortality, OR – 0.95; 95% CI – [0.85–1.07]. The surgery for AAA results showed a significant increase in the screening group, OR – 2.03; 95% CI – [1.59–2.59].

## DISCUSSION

The pooled data from the four RCTs have shown evidence that ultrasound screening significantly reduced AAA-related mortalities by 43.1%. The absolute risk in AAA-related mortality reduction (per 100,000) for the Chichester study, MASS, Western Australia and Viborg study is 36.2, 214.2, 140.7 and 206.0, respectively. These values are approximations for population-based screening. Despite the results, there are some inconsistencies present. MASS evaluated mortality solely based on death certificates, whereas the other studies used independent evaluators to assess patients that were suspected of an AAA-related mortality. This may

**Table 12.** Critical appraisal of RCTs using CASP tools.

CASP tools – RCT <sup>33</sup>	STUDY 1 <sup>34</sup>	STUDY 2 <sup>35</sup>	STUDY 3 <sup>36</sup>	STUDY 4 <sup>37</sup>
1. Did the study ask a clearly focused question?	✓	✓	✓	✓
2. Was this a randomised controlled trial (RCT) and was it appropriately so?	✓	✓	✓	✓
3. Were participants appropriately allocated to intervention and control groups?	–	–	–	✓
4. Were participants, staff and study personnel 'blind' to participants' study group?	×	×	×	×
5. Were all of the participants who entered the trial accounted for at its conclusion?	–	✓	✓	✓
6. Were the participants in all groups followed up and data collected in the same way?	✓	✓	✓	✓
7. Did the study have enough participants to minimise the play of chance?	–	✓	✓	✓
8. How were the results presented, and what were the main results?	✓	✓	✓	✓
9. How precise were these results?	✓	✓	✓	✓
10. Were all important outcomes considered so the results can be applied?	–	✓	–	×
<b>SCORING</b>	<b>TOTAL</b>	<b>14/20</b>	<b>17/20</b>	<b>16/20</b>
YES = ✓ = 2				
PARTIALLY = – = 1				
NO = × = 0				

have led to a possible over-estimation of AAA-related mortality, thus introducing bias in cases where cause of death was equivocal. Conversely, the results could show an under-estimation of AAA-related mortalities, if the cause of death is falsely attributed to any cause other than AAA-related.

Results showed that there was no significant evidence to support a reduction in all-cause mortality. This is to be expected, as AAA-related mortality only accounts for a small number of deaths in elderly men. Nonetheless, there is heterogeneity present in the results of the Western Australia study, which shows a decrease in all-cause mortality ( $n = 339$ ) in the screening group when compared to the control group. Only a difference of seven deaths was recorded that favoured screening for AAA-related mortalities; these results suggest that the difference in all-cause mortalities may be due to a flaw in the design of the study. Between randomisation and screening, there was a lapse of 32 months, during which 2,296 individuals selected for the study died. The following analysis of the results was carried out from the date screening was commenced and not from date of randomisation, which possibly introduced a further study design error.

Only the Chichester study included women in its study in which the evidence pointed towards a non-significant benefit from screening in reducing AAA-related or even all-cause mortality. However, due to an insufficient number of participants, the validity of these results is questionable.

Although all studies reported the same outcome, their methods differed. With AAA detection in the Western Australia study, individuals were referred back to their general practitioner for further evaluation and treatment. In the remaining studies, surveillance programmes were carried out and operated. The Viborg study only assessed mortalities from hospital records; this may have led to a large number of deaths from the community being overlooked. Furthermore, the degree to which these studies can be generalised to other countries is limited, as no one reported data on ethnicity, race or geographical location.

There were a number of limitations that applied in this review. Articles were limited to those that were free or available via an Athens account; this restricted the amount of available literature as many articles required a subscription. Further to this, only articles in English (including translations) were analysed and included. The retrieved articles were then subjected to limitations based on the author's judgement, thus incurring a form of selection bias. Conclusions regarding female subjects drawn from the review results could have been more valid and reliable, if the Chichester study had recruited a larger number of female participants, as well as having a

representative number of females included in the other studies. If all studies used the same method for randomisation and recording mortality, then the results could have been more accurately compared.

Although discrepancies are present in both the study designs and limitations of this review, overall they have had a minute effect on AAA-mortality, as the MASS results accounted for a large weight of the pooled results. The benefit of population-based screening is becoming evident as there are an increasing number of studies with comparable methods that are researching AAA screening via ultrasound. Nevertheless, the rate of elective AAA repair will increase, which may cause mortalities in individuals who have aneurysms detected via screening that may possibly never rupture.

## CONCLUSION

The use of the CASP tool to review the evidence indicates that population-based ultrasound screening has a significant effect in reducing AAA-related mortality in males aged 65–74. The risk of mortality from treatment is lower than that of ruptured aneurysms but still presents as a significant factor. Due to the paucity of evidence in current available literature, no definitive conclusions can be drawn regarding population-based screening for AAA in women, so it is therefore suggested that future studies should be carried out to assess the benefits and relative risks for this population. Cost-effectiveness, quality of life and the harms of ultrasound screening have not been specifically addressed in this review due to limited data, but it is acknowledged that these factors need to be carefully considered and evaluated before any population-based screening programme is implemented.

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# Can donepezil hydrochloride reduce the role of neuroleptic drugs in delirium? A case report

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**Background:** Recent evidence shows that a confirmed diagnosis of delirium increases both patient morbidity and mortality. Importantly, these increases are independent of patient age, and presence of co-morbid disease. In the last few years, there has been evidence that acetylcholinesterase inhibitors may have a limited role in managing episodes of mild/moderate delirium.

**Methods:** This case study reports a patient whose behavioral disturbances caused by delirium, responded well to donepezil hydrochloride in a nursing home in Dundee, United Kingdom.

**Results:** Our clinical case focuses on a patient who was diagnosed with a mixed picture delirium after developing PUO. This case report notes that Mr A, a patient already prescribed donepezil hydrochloride, saw an improvement in his behavioral symptoms after an increase in his dose. This enabled the patient to avoid receiving neuroleptic or benzodiazepine medication, known to be particularly problematic in older patients.

**Conclusion:** The authors tentatively propose that patients in community care already prescribed acetylcholinesterase inhibitors, may benefit from an increased dose in cases of mild delirium (where there is no clear cause or requirement for hospital admission). In line with the significant impact that delirium has upon older patients in community care, we would call for further studies looking at the influence that these medications may have on the sequelae of delirium in patients in the community.

**Keywords:** geriatrics; delirium; psychiatry; acetylcholinesterase inhibitors.

## INTRODUCTION

**D**elirium is the term used to describe a state of fluctuating organic mental confusion, usually of abrupt onset and relatively short duration.<sup>1,2</sup> It results in impaired attention and concentration, impaired consciousness, disordered perception, visual hallucinations, and autonomic features, such as sweating and tachycardia.<sup>3,4</sup> This condition is relatively common in older patients, with up to 56% of hospitalized geriatric patients developing delirium during their hospital stay.<sup>5</sup> Furthermore, a Dutch study of 3,627 residents noted that the prevalence of delirium in nursing and residential homes is 8.9% and 8.2%, respectively.<sup>6</sup> There are three types of delirium: hypoactive, hyperactive, and mixed (see Table 1).<sup>1-4,7-9</sup>

The general principles involved in the treatment of delirium include:

- treating any precipitating cause such as infection, dehydration, or hypoxia;
- optimizing the patient's environment (e.g. provision of ambient lighting);
- judicious use of psychotropic drugs, such as low-dose haloperidol, to manage particularly distressing behavioral disturbances.<sup>1-4,7-9</sup>

Interestingly, the neurotransmitter acetylcholine (ACh) has been implicated in delirium and, consequently, acetylcholinesterase inhibitors may have a role in managing some episodes of mild/moderate delirium.<sup>10</sup> This case study reports a patient with behavioral disturbances caused by delirium (secondary to pyrexia of unknown origin [PUO]) who responded well to donepezil hydrochloride (donepezil HCl), an acetylcholinesterase inhibitor, in a nursing home in Dundee, United Kingdom. The current evidence regarding the role acetylcholinesterase inhibitors may play in delirium will subsequently be discussed.

Increasing the dose of donepezil HCl is a novel clinical approach to managing behavioral disturbances in delirium. This change in the patient's treatment plan, alongside rationalizing his prescribed medications, and non-drug methods of delirium management, led to rapid patient recovery. Avoiding antibiotic prescription in patients with PUO and an inconclusive clinical picture of infection is important, particularly in nursing homes, to avoid antibiotic resistance and side-effects. This case study suggests that it may be prudent for clinicians who are asked to review patients with good baseline function who have developed a mild delirium with

**Table 1.** Description of the three forms of delirium.<sup>7-9</sup>

Hyperactive delirium (30%):

Patients become agitated and hyper-alert. Hyperactive delirium is associated with repetitive behaviors, wandering, hallucinations, and verbal/physical aggression.

Hypoactive delirium (25%):

Patients become quiet and withdrawn. It is important to consider depression as a differential diagnosis in such cases.

Mixed delirium (45%):

Patients have a fluctuating pattern of both hyperactive and hypoactive symptoms.

behavioral disturbance in a nursing home to avoid generic antibiotic prescription and consider if an increased dose of an acetylcholinesterase inhibitor may be of benefit (if already prescribed).

## CASE STUDY

### History

This case discusses an 86-year-old male (Mr. A), resident in a nursing home, who developed a mixed picture delirium after developing PUO.

#### Day 1

Nursing staff noted that Mr. A was reluctant to leave his bed (extremely unusual behavior for this particular patient). Mr. A became agitated when spoken to by clinical staff and became verbally and physically aggressive, which was also very unusual. His agitation brought on significant breathlessness (patient used accessory muscles and complained of 'feeling short of breath'). Importantly, Mr. A was not breathless at rest and when calm. After speaking to the previous night shift nursing team and reviewing patient records, Mr. A was noted to have been well up to the morning shift.

Mr. A had a past medical history of long-standing primary hypertension, angina pectoris, osteoporosis, and Alzheimer's disease, but generally kept in good health. Mr. A had not been treated for chest infection, urinary tract infection, or been diagnosed with delirium in the past. Prescribed medications included lisinopril 5 mg (once daily), donepezil HCl 10 mg (once daily), disodium etidronate 200 mg (once daily), and, as required, glyceryl trinitrate. The patient had been prescribed donepezil HCl for a 10-month period (on 3-month review) and was allergic to amoxicillin.

Despite his considerable cognitive impairment, Mr. A normally engaged well with his family, nursing/care staff, and other residents. Mr. A maintained good mobility, using a walker to move around the home. Finally, there were no residents in the nursing home who had been diagnosed with an infection.

The nursing team called for the patient's general practitioner (GP) to arrange a visit later in the day and make a medical assessment.

## Clinical assessment

### Day 1

While waiting for the GP, nursing staff took some baseline physiological measurements, including blood pressure (142/95 mmHg), heart rate (87 beats per minute), respiratory rate (26 breaths per minute when disturbed and 17 breaths per minute when quietly observed), and a tympanic temperature (37.9°C).

Also, the care team carried out a confusion assessment method (CAM) and a mini-mental state examination (MMSE) to assess the patient's cognition. The MMSE is useful in establishing whether a patient has a degree of cognitive impairment and is used to chart cognitive changes both acutely and chronically.<sup>11</sup> The MMSE assesses orientation in time and place, registration, attention and calculation, recall, language, repetition, and interpreting complex commands.<sup>12</sup> An MMSE score of  $\leq 23$  is the widely accepted and frequently used cutoff score in clinical practice.<sup>11,12</sup> The CAM has been widely used in research<sup>4</sup> and is a simple algorithm with four questions.<sup>4,13</sup> A diagnosis of delirium requires the presence of both and two, in addition to either three or four (see Table 2).

Clinical assessment showed that the patient had a 7-point reduction on his MMSE (from 19 to 12) and was positive in all four CAM domains. In addition, abnormal psychomotor behavior was documented during these cognitive assessments, including episodes of physical aggression and restlessness.

A clinical examination carried out in the afternoon by the patient's GP failed to isolate a cause for the patient's pyrexia. The patient was recorded as having heart sounds S1 + S2, a clear chest, a soft non-tender abdomen, and no obvious sign of discomfort when micturating. Vital signs were obtained again, and they showed the same clinical picture: continued pyrexia (37.8°C) and tachypnea only when agitated (29 breaths per minute).

The patient had blood labs taken by the GP, including full blood count (FBC), C-reactive protein (CRP), liver function tests (LFT), and urea and electrolytes (U&Es). Blood and urine cultures were sent for culture and sensitivity. In addition, the GP arranged for Mr. A to attend the local hospital the following morning to have a chest X-ray.

**Table 2.** The confusion assessment method (CAM).<sup>4,13</sup>

1. Acute onset and fluctuating course: This feature is assessed by asking an informant.
  - Is there evidence of a sudden change from the patient's previous mental state?
  - Did the abnormal behavior tend to fluctuate through the day?
2. Inattention: This feature is assessed by asking an informant.
  - Did the patients have difficulty focusing attention, were they easily distractible, or did they have difficulty keeping track of the conversation or what was happening?
3. Disorganized thinking: This feature is assessed by reviewing the patient.
  - Was the patient's thinking disorganized, was their conversation rambling or incoherent, was there unpredictable switching from subject to subject?
4. Altered consciousness: This feature is assessed by reviewing the patient.
  - Rate this patient's level of consciousness as *alert* [normal], *vigilant* [hyper alert], *lethargic* [drowsy, easily aroused], *stuporose* [hard to arouse], or *comatose* [unarousable].

It was felt at this time that a generic antibiotic prescription for PUO should be avoided, and the results of investigations should prompt anti-microbial therapy, if required. First, the patient was allergic to the first-line antibiotic that would be prescribed in this circumstance, according to the National Health Service Tayside guidelines.<sup>14,15</sup> Second, this patient demography has a higher risk of side effects with antibiotics<sup>16,17</sup> and, in this case, it was not clear whether the cause of the patient's delirium was in fact infective. Crucially, the patient was only breathless when agitated, so a care plan was developed to allow the patient to rest in his room and not be disturbed, unless clinically necessary.

#### Day 2

Shortly after having his chest X-ray taken, the patient became increasingly aggressive and uncooperative, making it difficult for nursing staff to ensure medication compliance. After a second GP review, the patient had his lisinopril and disodium etidronate stopped (short-term) and the dose of donepezil HCl increased to 10 mg (twice daily) as a way of trying to improve his behavioral symptoms. Other psychotropic medications were avoided, in this instance, as a result of their side effects.<sup>18-20</sup> Within 1 day of increasing the donepezil HCl dose, the patient's symptoms of aggression and agitation improved. This reduced his breathlessness as he was more relaxed in his environment. These behavioral improvements were not associated with any change in his recorded tympanic temperature (day 2 = 37.9°C).

Investigation results were obtained by the evening of day 2, noting mildly elevated white cell count ( $14.0 \times 10^9/L$ ) and CRP.<sup>12</sup> Selected investigation results are noted in Table 3.

In line with the patient's clinical improvement and lack of a strong clinical picture for the presence of an infection, it was felt that antibiotics would not be required unless the he became unwell again. Within 3 days, the patient's MMSE score returned to 19 and CAM results no longer suggested delirium. The dose of

donepezil HCl was reduced back to 10 mg (once daily) after these improvements were documented.

## DISCUSSION

Delirium is not a benign condition, with recent estimates placing mortality rates between 10 and 26%.<sup>21</sup> In recent years, the neurotransmitter ACh has been implicated in the complex neurophysiological processes involved in delirium.<sup>10</sup> ACh is an important neurotransmitter that is involved in the communication between nerve cells.<sup>11</sup> ACh has been shown to be associated with human sensory perception, memory, and attention.<sup>21,22</sup> Since 1997, deficiency in ACh has been linked to some of the classic symptoms experienced by patients with Alzheimer's disease, such as memory loss.<sup>23,24</sup>

This 'cholinergic hypothesis' led to the development of acetylcholinesterase inhibitors. These medications prevent the activity of acetylcholinesterase, the enzyme responsible for breaking down ACh in the brain. Thus, these medications increase the concentration of ACh in the brain and have been shown to help symptoms of memory loss and slow the behavioral changes associated with Alzheimer's disease.<sup>11,25</sup> There are three acetylcholinesterase inhibitors that are licensed for use in the United Kingdom, namely donepezil HCl,

**Table 3.** Selected investigation results of Mr. A.

Investigation	Investigation result
FBC	RBC $6.5 \times 10^{12}/L$ WCC $14.0 \times 10^9/L$ Platelets $190 \times 10^9/L$
CRP	12
U&Es	Sodium 142 mmol/L Potassium 4.5 mmol/L Urea 4.9 mmol/L
Blood culture and sensitivity	Negative growth
Urine culture and sensitivity	Negative growth
Chest X-ray	Reported as clear



rivastigmine, and galantamine.<sup>11,26</sup> These drugs can provide short- to medium-term improvements in patient memory symptoms.<sup>25</sup>

### ACh and delirium

There have been suggestions that ACh deficiency may be the cause of some of the clinical hallmarks of delirium, such as impaired memory, perceptual abnormalities, and inattention. Studies of cholinesterase inhibitors in patients with delirium suggest that these medications could have a role in reducing both the frequency and the duration of delirium episodes<sup>27,28</sup> and as a preoperative risk reducer for elderly patients undergoing elective surgery.<sup>29</sup> Furthermore, low preoperative plasma cholinesterase activity may be able to predict the risk of postoperative delirium in elderly patients.<sup>30</sup>

The only double-blind randomized placebo-controlled trial looking at ACh inhibitors and delirium noted disappointing results.<sup>31</sup> The study assessed the use of rivastigmine in critically ill patients admitted to the intensive care unit; however, the authors noted that rivastigmine did not decrease the duration of delirium and may have actually increased patient mortality, leading to halting of the study.<sup>31</sup> There were some problems and concerns voiced about the trial, including the design of the study and subject selection,<sup>32,33</sup> but these results have prompted fresh concerns about this treatment approach, especially in critically ill patients. Furthermore, almost one-third (29%) of the patients cannot take these memory-enhancing drugs due to gastrointestinal side effects, such as nausea, vomiting, and diarrhea.<sup>25</sup>

### Clinical case

Our clinical case focuses on an elderly male who was diagnosed with a mixed picture delirium after developing PUO. This case report notes that Mr. A, a patient already prescribed donepezil HCl, had improvement in his behavioral symptoms after an increase in his dose. This meant that he would not be on neuroleptic or

benzodiazepine medication, known to be particularly problematic in older patients.<sup>20</sup>

### LIMITATIONS

Clearly, there are limitations to any case study as a method of influencing clinical practice. Indeed, we have drawn some tentative conclusions based on one patient experience. Furthermore, our conclusions are somewhat limited as Mr. A is not a typical resident in a nursing home. Mr. A was diagnosed with PUO (not confirmed infection), kept generally well, and had never been previously diagnosed with delirium. Therefore, we cannot extrapolate our findings to many other patients residing in nursing and care home settings. However, we do feel that this case suggests that further research is required to assess whether acetylcholinesterase inhibitors may have a role in managing specific patients with mild delirium.

### A magic bullet for delirium?

It should be stressed that it is unlikely that a medication will ever be the sole treatment of delirium and replace good-quality nursing care and environmental adjustments (Table 4).<sup>35–37</sup> Any medication will complement non-drug therapies to improve outcomes for patients.

This is because delirium has an extremely complex pathophysiology<sup>37</sup> with cerebral inflammation,<sup>38</sup> the sickness behavior response,<sup>38</sup> and altered activity of the limbic–hypothalamic–pituitary–adrenal axis,<sup>38</sup> all proposed as potential mechanisms. Furthermore, in addition to altered homeostasis of ACh, patients with delirium commonly have increased cortisol levels,<sup>37</sup> altered serotonin levels,<sup>39,40</sup> altered concentrations of amino acids (such as tryptophan and tyrosine),<sup>39,40</sup> and decreased plasma glutamate levels.<sup>41</sup> Crucially, it is most likely that patients with delirium will have a number of concurrent metabolic disturbances rather than just one. Thus, a single drug intervention may only help one aspect of a complex physiological process. However, if this can be

**Table 4.** Risk factors; common precipitants and general measures to avoid delirium.<sup>7,34–37</sup>

Risk factors	Common precipitants	General measures to avoid delirium in patients
Increasing age	Hypoxia	Avoid unnecessary moving and transferring of patients
Polypharmacy	Metabolic and electrolyte abnormalities	Avoid prescribing high-risk drugs, if at all possible (opioids, benzodiazepines, barbiturates)
Surgery	Infections	Managing factors that optimize brain function (i.e. ensuring good oxygen supply and minimizing physiological stresses)
Substance abuse (alcohol, illicit substances)	Alcohol or sedative withdrawal	Orientation (familiar objects, continuity of nurses)
Postoperative states		Maintain mobility
CNS causes (structural, infective, thrombotic)		

done using medications with a lower side effect profile to the current sedative medications, it would certainly be beneficial to clinical practice.

## CONCLUSION

Delirium can be secondary to brain damage and to metabolic disturbances, with reduced levels of ACh potentially involved. This clinical case focused on a patient who was diagnosed with a mixed picture delirium after developing PUO. This case report notes that Mr. A, a patient already prescribed donepezil HCl, had an improvement in his behavioral symptoms after an increase in his donepezil HCl dose.

The authors tentatively propose that patients in nursing homes already prescribed acetylcholinesterase inhibitors may benefit from an increased dose in cases of mild delirium (where there is no clear cause or requirement for hospital admission). In line with the significant impact that delirium has upon older patients in residential and nursing home care, we would call for further studies looking at the influence that these medications may have on the sequelae of delirium in patients in these environments.

## CONSENT

Consent has been given for this case to be published and the consent form can be reviewed by the editor upon request.

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## Too small to fail

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**O**n December 7, 2012, Nicholas Kristof,<sup>1</sup> two-time Pulitzer Prize winning journalist, wrote a compelling article about people in poverty in the United States. The article, which appeared in the *New York Times*, describes the plight of young children who are failing in school and who are not acquiring the skills needed to move forward in their education, and tragically, in some cases, parents are allowing them to fail. It is their children's illiteracy that enables the parents to receive Supplemental Security Income (SSI) payments from the government. These payments, meant for supporting families of children with severe functional limitations, are funds that the family uses to survive. The parents were most likely members of an educational system that failed them as well, leaving them without the academic-based life skills needed to get better paying jobs. And so a vicious cycle results with far-reaching consequences, including an abysmal education, unemployment, poorer health, and inadequate healthcare. Solutions to breaking this cycle seem impossible, but we cannot accept failure and give up. Solutions will begin with small steps, which is how every journey begins. And confidence must be drawn from what Mark Twain once said: 'They didn't know it was impossible, so they did it.'

Ruffing and Pavetti<sup>2</sup> criticize Kristof's article, stating that his information on SSI 'should be rooted in facts and data, not impressions, misimpressions, and anecdotes,' and go on to iterate, 'This is *not* to say *no* such incidents occur, or that all families take full advantage of supplemental literacy or tutoring programs that may be available (though not always accessible) to them.' But they would prefer commentary based on 'actual research' versus 'anecdotal stories.' Kristof, never averse to raising the specter of social problems of the minority, leaves the conducting and analyzing of research to the academics and think tanks. However, he does, in fact, cite research he believes supports his claims. A 2011 report from the Committee on Ways and Means found that four decades ago, approximately 1% of poor children had support from the SSI payment system.<sup>3</sup> A 2012 report from the Social Security Administration cited that 8% of children in poverty today are enrolled in SSI.<sup>4</sup> This increase in SSI support correlates with less stringent eligibility requirements for families in the program and ends up with the majority of beneficiaries transitioning into SSI in adulthood and the others being

largely unprepared for life without SSI.<sup>5</sup> Of significance is a finding by DeCesaro and Hemmeter.<sup>6</sup> 'The choice to return to work might be especially difficult for many child SSI recipients who have unmet health needs and fear losing future access to health benefits through Medicaid'.

*Save the Children* is taking steps to improve literacy by striving to find answers for children whose poverty has affected their education. *Save the Children* is a non-profit organization dedicated to helping children both in the United States and around the world.<sup>7</sup> They respond to emergency situations, where medical aid, shelter, and other relief are needed, and they also administer strategic programs to improve the education of children. They posit that 'Education is the road that children follow to reach their full potential in life'.<sup>8</sup> They have initiated education projects training teachers in the use of more effective teaching strategies, offering ways for volunteers to get children to read and do math outside of school hours, and promoting the power of artistic expression to help children heal, learn, and do better in school. In the United States, they are working in poverty-stricken areas, teaching parenting skills and providing parents with their greatest need – hope. Kristof is getting the message out, believing that helping struggling children should be a national priority. He contends, 'They're too small to fail.'

The implications of illiteracy factor into all facets of a person's life, including their healthcare. People require health literacy, which is defined as the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions.<sup>9</sup> Individuals with literacy problems are unable to take full advantage of healthcare services. Weir<sup>10</sup> cogently delineates the literacy spectrum and offers a reflection:

There are several types of literacy. Prose literacy is the ability to understand and use information from texts such as news stories and fiction, whereas document literacy is the ability to locate and use information from documents such as job applications and transportation schedules. Numerical literacy is the ability to balance a checkbook or complete an order form. To package these varied skills into the binary outcome of "pass or fail," as the provincial test has done, too starkly paints the shades of literacy in black

and white, and knocks the self-esteem of many Ontario teenagers in the process.

Self-esteem is intrinsically tied to illiteracy. A recent qualitative study of the perspectives of adults with low literacy skills revealed how much patients feared that their poor reading skills would be exposed. "I don't tell anybody or say anything [about my illiteracy]," said one. "They might think I'm a bad person." However, the consequence of non-disclosure in a health care setting is uninformed consent. "A lot of times I thought, 'My God, I am signing my life away,' said another study participant.

The effectiveness of the healthcare we offer is influenced by the literacy of our patients. If patients cannot read directions on their medications, they are in jeopardy. If caregivers do not follow medical protocols because they have limited literacy capabilities, dangerous consequences can result. If people cannot do the math needed to properly dispense medications, they can over-or-under dose. In 2003, the National Assessment of Adult Literacy (NAAL) introduced a health literacy component to their national assessment of adults' ability to use their literacy skills; the health component measures understanding health-related materials and forms.<sup>11</sup> Findings indicate poverty and limited education negatively affect health literacy.

Literacy begins by teaching all children how to read and compute so that one day they can get good jobs, effectively handle their healthcare, and lead healthy, fulfilling lives. In our country, people worry about the banks that might be *too big to fail*. What about the children who do not have a voice in voting or a platform so their needs can be heard? By assuring literacy for every child, we would be taking a great stride to embolden those who are *too small to fail*.

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