Fifty years of thoracic surgical research in South Africa
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We aimed to investigate the scope and trends in clinical research in South African thoracic surgery between 1955 and 2006 and to measure its impact on clinical practice.

Method
An electronic search was performed of Medline via Pubmed, The Africa-Wide:NilPad database of African and South African publications (Africa-Wide:NilPad) and the Cochrane Libraries of systematic reviews and clinical trials and a manual search was done of the SA Respiratory Journal, SA Radiology Journal (previously Imaging SA), Cardiovascular Journal of SA and SA Heart Journal.

The search covered 52 years between January 1955 and December 2006. It was performed using the names of specialist surgeons who have practised cardiothoracic surgery in South Africa (SA), universities in SA that have departments of cardiothoracic surgery, academic teaching hospitals, cities in which the university teaching units are found, and the word ‘cardiothoracic’.

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We aimed to investigate the scope and trends in clinical research in South African thoracic surgery between 1955 and 2006 and to measure its impact on clinical practice. The vulnerability of a small speciality in a developing country is illustrated by the clear trends that emerged. The study provides important indicators for future research, highlights the need for a national database of clinical experience, and emphasises the importance of rekindling interest and a culture of research in thoracic surgery.

Results
Eight hundred and sixty-three cardiothoracic publications were produced by the 169 surgeons who worked in SA during the 52-year period between 1955 and 2006.

No publications were found in the Cochrane clinical trials or Cochrane systematic review libraries (Fig. 1). General thoracic surgical publications totalled 252, including 22 non-cardiac trauma publications.

Publication trends
The quantitative trend in thoracic publications is shown in Fig. 2. Peak productivity occurred between 1980 and 1989, with a total of 99 (9.9 publications per year). The mean annual publication rate over the 52 years was 4.8 for thoracic publications (standard deviation (SD) 4.0), compared with 11.2 publications per year for the combined cardiac and transplantation literature.

University publications decreased markedly after the 1980s, with a shift towards the private sector. The private sector provided 14% of the national output after 1995 and 20% after 2000, placing it third in the rankings of publications after the University of Cape Town (31) and the University of KwaZulu-Natal (11) since 1995.

Journals
The publications appeared in 56 journals, and the most frequently used are shown in Table I. The South African Medical Journal (S Afr Med J) published most publications (35%) up to
common problem of persistent pleural spaces in chronic empyema with or without broncho-pleural fistula.

The influence of the human immunodeficiency virus (HIV) on thoracic surgical patients was discussed in 2 papers, one on chronic lung disease in 194 patients and the other on issues confronting the surgeon treating HIV-infected patients.

Twenty articles reported on 798 patients with carcinoma of the bronchus: 9 were surgical in focus (558 patients), while 6 dealt with chemotherapy and/or radiotherapy in lung cancer. Multimodality therapy in advanced disease was reviewed in 2 papers, one of which dealt with the importance of staging and survival after complete resection in patients with or without N2 disease. Thoracic surgeons were first authors in 11 papers on bronchial carcinoma (55%).

There were 19 papers on oesophageal carcinoma, reporting on 678 patients in total. Articles discussing palliation of dysphagia accounted for most of these, and there were also 4 scientific studies, 1 investigating the role of the human papillomavirus and 3 chromosomal changes in oesophageal carcinoma.

There were 47 trauma publications from cardiothoracic surgeons, 22 (133 patients) discussing non-cardiac and non-great vessel trauma. Penetrating trauma was the most common topic.

**Study design**

Clinical observations in thoracic surgery were reported in 193 (77%) of all publications: 2 randomised controlled trials (RCTs), 6 cohort studies, 87 descriptive series reviews, 94 case reports and 4 letters. There were no systematic reviews or meta-analyses (Table II).

One RCT comparing cefoxitin with cephalothin in 19 patients treated for chronic destructive pneumonitis had a thoracic surgeon as first author. The other RCT, investigating etoposide scheduling in the treatment of small-cell lung carcinoma in a series of 78 patients, had a surgeon as a co-author.

Of the 6 cohort studies, 5 were retrospective and 1 was prospective. One retrospectively compared the survival of pleuro-pneumonectomy with parietal pleurectomy in mesothelioma. A second compared surgical with medical management of childhood bronchiectasis. Goldstraw and Bach also compared gastric emptying after oesophagectomy with normal controls. Goldstraw also examined the influence of pleural irritation and antibiotics on the incidence of post-pneumonectomy empyema. A 5th study compared postoperative 5-year survival between groups of patients with pancreatic PN disease and those with less advanced nodal staging in non-small-cell lung cancer. A non-randomised prospective study reported on the effect of normovolemic haemodilution in 10 patients before thoracic surgery.

Of the 252 publications, 189 (75%) had a thoracic surgeon as first author, of which 141 reported clinical data in case
these 141 papers were assessed on the Oxford Centre for Evidence-based Medicine model for levels of evidence (Table II), and 5% of papers with a thoracic surgeon as first author were rated grade B. Statistical analysis in the reports on patient series was almost exclusively by simple proportions.

**Discussion**

The overall number of publications (252), and especially the number of publications with a thoracic surgeon as first author (189), is low relative to the size of the SA population, the burden of thoracic disease and the number of surgeons who practised cardiothoracic surgery over the 50-year period (169). The overall mean output per university is low at 0.6 publications per year; 5 of the 8 university departments of cardiothoracic surgery in SA collectively published only 22 (9%) thoracic surgery articles (Fig. 2). Similar reviews could not be found for comparison with other countries, or with other specialist disciplines in SA.

The most obvious trends from this analysis are the decrease in publications and the shift to a non-indexed journal for publication since the 1980s. It is not surprising that inflammatory pleuro-pulmonary disease is the most frequent topic of publication, as it represents the bulk of admissions to thoracic surgical wards in SA. However, this literature does not address the complex, frequent and most debilitating problem of persistent pleural spaces in chronic empyema with or without bronchopleural fistulas. Moreover, tuberculosis and HIV are poorly represented in the SA thoracic surgical literature in spite of their high incidence in our communities.

Considering their burden of disease, there are few publications on lung and oesophageal cancer. The few trauma

### Table I. Most frequently published in journals

<table>
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<tr>
<th>Journal</th>
<th>Journal citation impact factor</th>
<th>No. of publications</th>
<th>%</th>
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<tbody>
<tr>
<td>S Afr Med J</td>
<td>1.268</td>
<td>88</td>
<td>35</td>
</tr>
<tr>
<td>Thorax</td>
<td>6.226</td>
<td>28</td>
<td>11</td>
</tr>
<tr>
<td>S Afr Resp J</td>
<td>Not reviewed</td>
<td>19</td>
<td>8</td>
</tr>
<tr>
<td>S Afr J Surg</td>
<td>0.265</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>Ann Thorac Surg</td>
<td>2.022</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>J Thorac Cardiovasc Surg</td>
<td>3.354</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Br J Surg</td>
<td>4.304</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Eur J Cardiothoracic Surg</td>
<td>2.011</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Chest</td>
<td>4.143</td>
<td>4</td>
<td>2</td>
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</table>

### Table II. Oxford centre for evidence-based medicine levels of evidence (N=141)

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Publications</th>
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<tbody>
<tr>
<td>1a</td>
<td>SR with homogeneity of RCTs</td>
<td>0</td>
</tr>
<tr>
<td>1b</td>
<td>Individual RCT (narrow CI)</td>
<td>0</td>
</tr>
<tr>
<td>1c</td>
<td>All or none</td>
<td>0</td>
</tr>
<tr>
<td>2a</td>
<td>SR with homogeneity of cohort studies</td>
<td>0</td>
</tr>
<tr>
<td>2b</td>
<td>Individual cohort study</td>
<td>6</td>
</tr>
<tr>
<td>2c</td>
<td>Low-quality RCT</td>
<td>1</td>
</tr>
<tr>
<td>3a</td>
<td>Outcome research</td>
<td>0</td>
</tr>
<tr>
<td>3b</td>
<td>SR with homogeneity of case control studies</td>
<td>0</td>
</tr>
<tr>
<td>3c</td>
<td>Individual case-control study</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Case series (and poor-quality cohort and case-control studies)</td>
<td>134</td>
</tr>
<tr>
<td>5</td>
<td>Expert opinion without critical appraisal, or based on physiology bench research or first principles</td>
<td>0</td>
</tr>
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Grades of recommendation | Explanation                                                                 | Number of papers (N=141)* |
-------------------------|-----------------------------------------------------------------------------|--------------------------|
A                        | Consistent with level 1 studies                                             | 7 (5%)                   |
B                        | Consistent with level 2 or 3 studies or extrapolations from level 1 studies | 134 (95%)                |
C                        | Level 4 studies or extrapolations from level 2 or 3 studies                 |                          |
D                        | Level 5 evidence or troubling or inconclusive evidence from any level       |                          |

*Papers reporting on clinical observations in a patient or series of patients, with a thoracic surgeon as first author. SR = systematic review; RCT = randomised controlled trial; CI = confidence interval.
publications may be explained by trauma units increasingly managing chest trauma, with few cases being referred to cardiothoracic surgeons.

The SA thoracic surgical literature is almost entirely observational in design. There are no RCTs investigating surgical topics, and no systematic reviews or meta-analyses. This is not necessarily a major criticism as most of the international thoracic surgery literature is observational with few published RCTs.

In the opinion of some, the emphasis on observational studies has devalued surgical research. Of 119 RCTs published in three major cardiothoracic journals in 1989 and 1999, only 6 were thoracic surgical. Problems inherent in conducting RCTs in cardiothoracic surgery were illustrated; in only 15% could recommendations be made for practice change.

The authors concluded that, comparative analyses of large series could possibly provide stronger evidence for clinical recommendations. Based on the grades of recommendation in Table II, few SA publications appear to be able to influence clinical practice.

Explaining the decrease in research activity in thoracic surgery in SA since the mid-1980s requires understanding of a complex interplay of many factors. The loss of surgeons with an interest in thoracic surgery from academic practice to emigration, retirement and private practice is significant. At the end of 2006 an estimated 31% (34/109) of clinically active SA cardiothoracic surgeons were working abroad, similar to Health Systems Trust 2006 statistics showing that 37% of SA-trained medical doctors were working abroad.

Rapid private practice development in the 1980s has provided highly accessible clinical services for approximately 7 million of the 47 million people in SA. Private practice has become increasingly attractive to health care professionals owing to the wide differential in income and general working conditions between state and private practice.

Investigating the factors responsible for the critical shortage of general surgeons in SA, the Association of Surgeons of SA (ASSA) concluded that the remuneration of state specialist surgeons lagged far behind other state professions such as engineers, judges, magistrates, municipal managers and airline pilots. Salaries compared poorly with surgical counterparts. SA (ASSA) concluded that the remuneration of state specialist surgeons lagged far behind other state professions such as engineers, judges, magistrates, municipal managers and airline pilots. Salaries compared poorly with surgical counterparts. SA (ASSA) concluded that the remuneration of state specialist surgeons lagged far behind other state professions such as engineers, judges, magistrates, municipal managers and airline pilots. Salaries compared poorly with surgical counterparts. SA (ASSA) concluded that the remuneration of state specialist surgeons lagged far behind other state professions such as engineers, judges, magistrates, municipal managers and airline pilots. Salaries compared poorly with surgical counterparts.

Trainees hold the view that an academic career has become unattractive. Furthermore, most cardiothoracic surgeons in SA are more interested in cardiac than thoracic surgery as a career. At the end of 2006, SA had 8 surgeons practising thoracic surgery exclusively since 2006, 1 has retired, 1 has died, 1 has emigrated, and 2 might retire within the next 5 years.

Finally, health care reform policy since 1994 has reduced state funding of tertiary medicine, resulting in far fewer referrals and operations performed in teaching departments. Professor W van der Merve, in an address to the Free State Branch of the South African Medical Association on 28 May 2008, reported that 31% of consultant posts in SA tertiary level training hospitals are unfilled and remain frozen by the state This understaffing of academic departments at all levels diminishes the ability to sustain many important departmental functions, the most vulnerable of which is research.

References