



WESTMEAD
HOSPITAL

Evaluation of Use Mobile versus Radiology Department Chest X-rays in Older Adults, in a Major Teaching Hospital

Dr. Andrew Emerson, Dr. Lakshmi Venkateswaran,
Dr. Charles Wang, Ms. Nadine Thompson, Mr. Timothy McCosker,
Dr. Michelle Moscova, Dr. Doungkamol Sindhusake, Dr. Raymond
Cabela, Associate Professor Noel Young

AGEING:
THE GOLDEN
OPPORTUNITY

50th
AAG
CONFERENCE

08 - 10 NOVEMBER 2017
CROWN PERTH, WESTERN AUSTRALIA



AAG
Australian
Association of
Gerontology

INTRODUCTION

- UN Population Report 2017-the population aged >60 is 13% of the world population, in 2050 this will rise to 25%
- Mortality in elderly –heart disease, chronic respiratory disease, pneumonia
- Chest X-rays cost effective imaging modality

AGEING:
THE GOLDEN
OPPORTUNITY

50th
AAG
CONFERENCE

08 - 10 NOVEMBER 2017
CROWN PERTH, WESTERN AUSTRALIA



AAG
Australian
Association of
Gerontology

INTRODUCTION

- Chest X-rays performed in the radiology suite (departmental CXR) or bedside (mobile CXR)
- The American College of Radiologists recommend mobile CXRs
 - Acute cardiopulmonary disorder
 - Following line insertion
 - Mechanically ventilated
- There is no known literature comparing chest X-rays (CXR) in the radiology suite to mobile CXRs

AGEING:
THE GOLDEN
OPPORTUNITY

50th
AAG
CONFERENCE

08 - 10 NOVEMBER 2017
CROWN PERTH, WESTERN AUSTRALIA



AAG
Australian
Association of
Gerontology

INTRODUCTION

- Radiographers noted mobile CXR requests for other reasons in geriatric patients –
Eg. delirium, immobility
- Geriatric patients
 - Age ≥ 70 years
 - Two or more medical issues
 - No surgical intervention

AGEING:
THE GOLDEN
OPPORTUNITY

50th
AAG
CONFERENCE

08 - 10 NOVEMBER 2017
CROWN PERTH, WESTERN AUSTRALIA



AAG
Australian
Association of
Gerontology

AIM

- Compare mobile and departmental CXRs to identify factors that affect X-ray requests

AGEING:
THE GOLDEN
OPPORTUNITY

50th
AAG
CONFERENCE

08 - 10 NOVEMBER 2017
CROWN PERTH, WESTERN AUSTRALIA



AAG
Australian
Association of
Gerontology

METHODS

- Retrospective review of de-identified electronic patient data collected from the RIS from 1st July 2015-2016
- Inclusion criteria: Patient admitted under geriatric team with CXR taken in the ward
- Exclusion criteria: Geriatric patients with CXR performed in ED or geriatric patients under other specialty teams

AGEING:
THE GOLDEN
OPPORTUNITY

50th
AAG
CONFERENCE

08 - 10 NOVEMBER 2017
CROWN PERTH, WESTERN AUSTRALIA



AAG
Australian
Association of
Gerontology

METHODS

1. Reasons for request
2. Patient characteristics
3. Imaging times
4. Radiation exposure
5. Repetitions with no clinical change in the patient in a 24 hour period-adequacy



METHODS

- Reasons for request with classified into the 11 most common reasons:

Respiratory infection, atelectasis, pulmonary oedema, pleural effusion, foreign body, line insertion, obstructive airways disease, pneumothorax, malignancy, rib fractures, unclear aetiology.



Table 1 –Keywords used to classify requests into the following categories
1.Respiratory tract infection
Septic screen, febrile, pneumonia, consolidation, chest infection, aspiration, sepsis unknown origin, chills, Raised WCC ,increasing CRP, delirium screen, low grade temp, URTI, TB, raised inflammatory markers, shivers, productive cough, bronchial breathing, HAP (hospital acquired pneumonia), strep pneumonia bacteraemia, cough sputum positive alpha haemolytic strep, chesty cough, influenza B+, Strep pneumonia, MSSA in sputum+, SOB and temp, <u>parapneumonic</u> effusion, upper airway secretions
2. Post –Line Insertion
Confirm NG /PICC line
3. Pulmonary oedema
Fluid overload, pulmonary oedema, CCF, APO, fluid status, diastolic failure pedal oedema to knees, over fluid restriction, cardiomyopathy and sob, received IV diuresis, overload, PO (pulmonary oedema)

**AGEING:
THE GOLDEN
OPPORTUNITY**

50th
AAG
CONFERENCE

08 - 10 NOVEMBER 2017
CROWN PERTH, WESTERN AUSTRALIA



AAG
Australian
Association of
Gerontology

METHODS

- Patient demographics including history of falls, delirium, immobility, dependence on activities of daily living
- In-hours (8am-5pm weekday) and after-hours CXRs
- Number of repetitions within a 24hr period (no change clinical condition)

AGEING:
THE GOLDEN
OPPORTUNITY

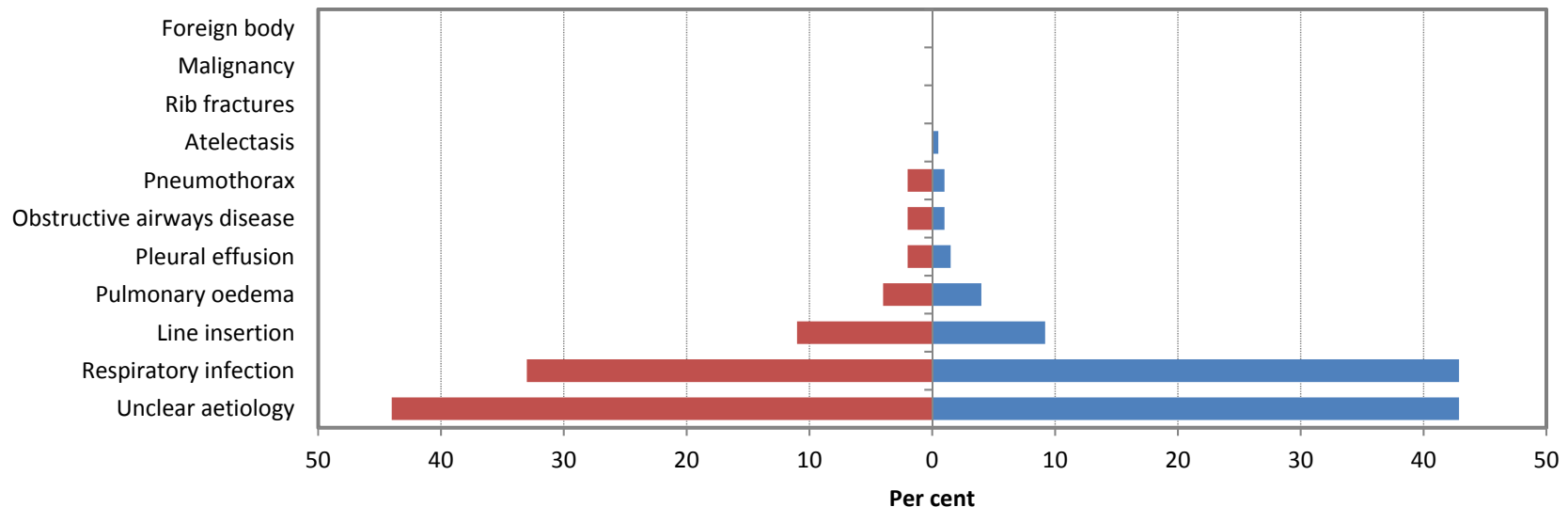
50th
AAG
CONFERENCE

08 - 10 NOVEMBER 2017
CROWN PERTH, WESTERN AUSTRALIA



AAG
Australian
Association of
Gerontology

REASONS FOR CXR REQUESTS



- More than 40% of mobile and departmental CXRs are ordered for an unclear aetiology
- The 3 most common reasons for ordering CXRs (mobile, departmental): rule out respiratory infection, line insertion, pulmonary oedema

AGEING:
THE GOLDEN
OPPORTUNITY

50th
AAG
CONFERENCE

08 - 10 NOVEMBER 2017
CROWN PERTH, WESTERN AUSTRALIA



AAG
Australian
Association of
Gerontology

PATIENT DEMOGRAPHICS

TABLE 2: BASELINE DEMOGRAPHIC CHARACTERISTICS OF PATIENTS

	Departmental Chest X-ray	Mobile Chest X-ray	P value
Median age (Percentile 25 th -75 th , year)	86 (81-91)	84 (78-89)	P<0.001
Gender (%)			p = 0.84
Male	289 (42)	116 (43)	
Female	400 (58)	156 (57)	
Residence (%)			p = 0.32
-Aged care facility	262 (38)	114(41)	
-House/unit	428 (62)	161(59)	
Dementia/mild cognitive impairment (%)	178 (27)	83 (23)	p = 0.18
Delirium (%)	148 (21)	73(21)	p = 0.94
Immobility (%)	93 (16)	42(15)	p = 0.86
Stroke (%)	88 (13)	35 (12)	p = 0.54

PATIENT DEMOGRAPHICS

TABLE 2: BASELINE DEMOGRAPHIC CHARACTERISTICS OF PATIENTS

	Departmental Chest X-ray	Mobile Chest X-ray	P value
Median age (Percentile 25 th -75 th , year)	86 (81-91)	84 (78-89)	P<0.001
Gender (%)			p = 0.84
Male	289 (42)	116 (43)	
Female	400 (58)	156 (57)	
Residence (%)			p = 0.32
-Aged care facility	262 (38)	114(41)	
-House/unit	428 (62)	161(59)	
Dementia/mild cognitive impairment (%)	178 (27)	83 (23)	p = 0.18
Delirium (%)	148 (21)	73(21)	p = 0.94
Immobility (%)	93 (16)	42(15)	p = 0.86
Stroke (%)	88 (13)	35 (12)	p = 0.54

PATIENT DEMOGRAPHICS

TABLE 2: BASELINE DEMOGRAPHIC CHARACTERISTICS OF PATIENTS

	Departmental Chest X-ray	Mobile Chest X-ray	P value
Falls in community (%)	232 (34)	84 (23)	p<0.001
Falls in hospital (%)	35 (5)	14(5)	p = 0.83
ICU admission (%)	12 (2)	30 (10)	p<0.001
Intubated	0 (0)	27 (7)	p<0.001
CPAP/BiPAP (%)	28 (4)	43 (14)	p<0.001
Function-Percentage independent (%)			
-Grooming	339 (50)	110 (31)	p<0.001
-Feeding	400 (60)	134 (35)	p<0.001
-Showering	253 (38)	82 (25)	p<0.001
-Toileting	311 (47)	100 (29)	p<0.001
Continent			
-Urine-Yes	391 (62)	141(37)	p<0.001
-Faeces-Yes	458 (72)	164 (40)	p<0.001

AG
TH
OP

PATIENT DEMOGRAPHICS

TABLE 2: BASELINE DEMOGRAPHIC CHARACTERISTICS OF PATIENTS

	Departmental Chest X-ray	Mobile Chest X-ray	P value
Falls in community (%)	232 (34)	84 (23)	p<0.001
Falls in hospital (%)	35 (5)	14(5)	p = 0.83
ICU admission (%)	12 (2)	30 (10)	p<0.001
Intubated	0 (0)	27 (7)	p<0.001
CPAP/BiPAP (%)	28 (4)	43 (14)	p<0.001
Function-Percentage independent (%)			
-Grooming	339 (50)	110 (31)	p<0.001
-Feeding	400 (60)	134 (35)	p<0.001
-Showering	253 (38)	82 (25)	p<0.001
-Toileting	311 (47)	100 (29)	p<0.001
Continent			
-Urine-Yes	391 (62)	141(37)	p<0.001
-Faeces-Yes	458 (72)	164 (40)	p<0.001

AG
TH
OP

PATIENT DEMOGRAPHICS

TABLE 2: BASELINE DEMOGRAPHIC CHARACTERISTICS OF PATIENTS

	Departmental Chest X-ray	Mobile Chest X-ray	P value
Falls in community (%)	232 (34)	84 (23)	p<0.001
Falls in hospital (%)	35 (5)	14(5)	p = 0.83
ICU admission (%)	12 (2)	30 (10)	p<0.001
Intubated	0 (0)	27 (7)	p<0.001
CPAP/BiPAP (%)	28 (4)	43 (14)	p<0.001
Function-Percentage independent (%)			
-Grooming	339 (50)	110 (31)	p<0.001
-Feeding	400 (60)	134 (35)	p<0.001
-Showering	253 (38)	82 (25)	p<0.001
-Toileting	311 (47)	100 (29)	p<0.001
Continent			
-Urine-Yes	391 (62)	141(37)	p<0.001
-Faeces-Yes	458 (72)	164 (40)	p<0.001

AG
TH
OF

CXR CHARACTERISTICS

TABLE 3: CHARACTERISTICS OF CHEST X-RAYS PERFORMED IN THE DEPARTMENT VERSUS USING MOBILE UNIT

Characteristics	Mobile	Departmental	p-value
Time to completion (minutes) -Median (25 th – 75 th percentile)	36.3 (18.0 – 152.3)	167.4 (95.9 – 467.1)	P<0.001
Per cent of X-rays repeated in a 24-hour period	26.1% (173/664)	4.6% (52/1144)	p<0.001
Percent of X-rays repeated in a 24hour period with no change in clinical condition	5.6%(37/664)	0.7% (8/1144)	p<0.001
Per cent of chest X-rays performed within normal hours	40.5% (269/664)	69.5% (795/1,144)	p<0.001
Percentage of X-rays in AP view	100 (664/664)	72.3 (414/573)	p<0.001

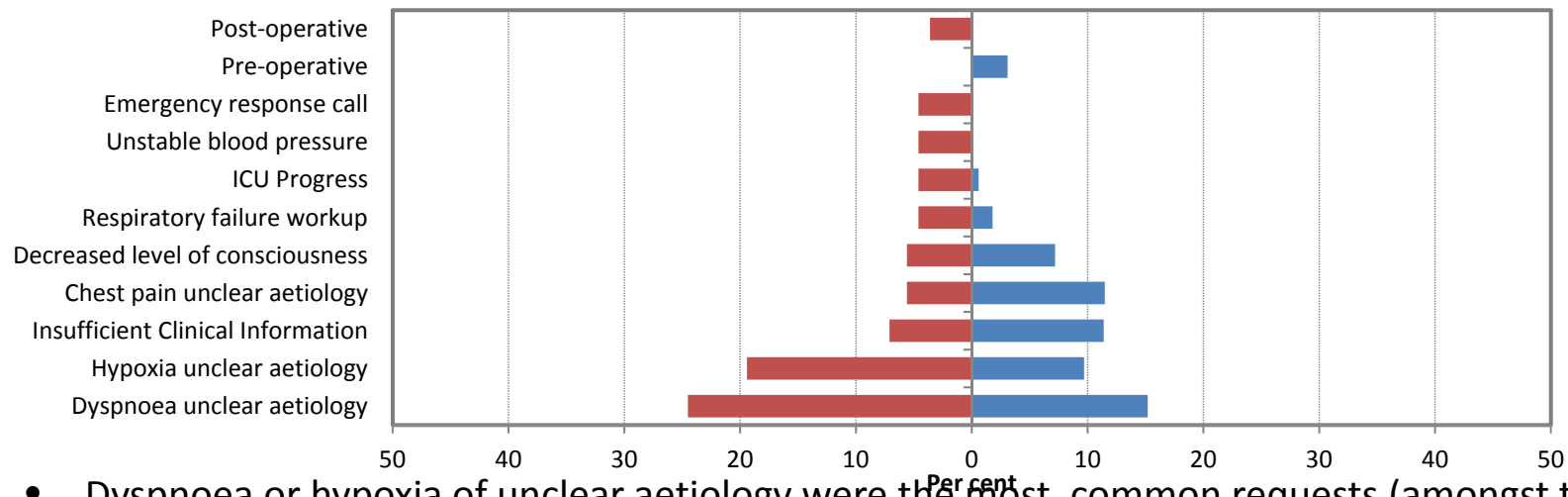
RADIATION DOSAGE

TABLE 4: MEDIAN EFFECTIVE DOSE OF RADIATION (25TH-75TH PERCENTILE)

Chest AP	0.059mSv (0.044-0.076mSv)
Chest PA	0.056mSv (0.045-0.070mSv)
Chest lateral (standing)	0.204mSv (0.147-0.314mSv)
Chest lateral (in bed)	0.493mSv (0.254-0.980mSv)

REASONS FOR CXR REQUESTS

UNCLEAR AETIOLOGY



- Dyspnoea or hypoxia of unclear aetiology were the most common requests (amongst the requests for unclear aetiology) for a mobile or departmental CXR
- Insufficient clinical information was present in 5% departmental and above 10% mobile CXRs

SUMMARY OF FINDINGS

- ACR criteria used for requesting mobile CXRs in a geriatric population
- Geriatric syndromes (immobility, delirium) did not influence CXR requests
- Frailty associated with mobile CXRs independent of mobility
- Falls were associated with requesting departmental CXRs

AGEING:
THE GOLDEN
OPPORTUNITY

50th
AAG
CONFERENCE

08 - 10 NOVEMBER 2017
CROWN PERTH, WESTERN AUSTRALIA



AAG
Australian
Association of
Gerontology

SUMMARY OF FINDINGS

- Median time to complete departmental CXRs four and a half times as long as departmental (167mins vs 36mins)
- Departmental CXRs higher total radiation due to more views of the chest
- Two thirds of mobile CXRs ordered after hours



SUMMARY OF FINDINGS

- Mobile CXRs were 8x more likely to be repeated in 24hrs (no change clinical condition)
- Reason for repeating:
 - Mobile CXR: Respiratory tract infections
 - Departmental CXR: Line insertion
 - 62.5% were AP CXRs



CLINICAL IMPLICATIONS

- Increasing mobile CXR service in hospital may not lead to improvement in patient care-higher rate of repetition-needs further investigations
- Mobile CXRs in nursing homes stated to reduce healthcare expenditure -however these studies were based on assumption diagnostic accuracy similar to departmental CXR (Vigeland et al 2017)



CLINICAL IMPLICATIONS

- Frailty another factor to be considered when requesting mobile CXRs in geriatric patients

AGEING:
THE GOLDEN
OPPORTUNITY

50th
AAG
CONFERENCE

08 - 10 NOVEMBER 2017
CROWN PERTH, WESTERN AUSTRALIA



AAG
Australian
Association of
Gerontology

CONCLUSION

Judicious requesting of mobile CXRs in geriatric patients is necessary

AGEING:
THE GOLDEN
OPPORTUNITY

50th
AAG
CONFERENCE

08 - 10 NOVEMBER 2017
CROWN PERTH, WESTERN AUSTRALIA



AAG
Australian
Association of
Gerontology

REFERENCES

[Vigeland E](#), [Bøhm RE](#), [Rostad A](#), [Lysdahl KB](#). Mobile X-ray service for nursing homes. [Tidsskr Nor Laegeforen](#). 2017 Feb 7;137(3):198-202.

Eklund K, Klefsgard R, Ivarsson B, Geijer M. Positive experience of a mobile radiography service in nursing homes. *Gerontology*. 2012;58(2):107-11.

[Dozet A](#)¹, [Ivarsson B](#)², [Eklund K](#)³, [Klefsgård R](#)⁴, [Geijer M](#)^{5,6}. Radiography on wheels arrives to nursing homes - an economic assessment of a new health care technology in southern Sweden. [J Eval Clin Pract](#). 2016 Dec;22(6):990-997

Kjelle, E. and K. B. Lysdahl (2017). "Mobile radiography services in nursing homes: a systematic review of residents' and societal outcomes." *BMC Health Services Research* **17**: 231.

[Ticinesi A](#)¹, [Lauretani F](#), [Nouvenne A](#), [Mori G](#), [Chiussi G](#), [Maggio M](#), [Meschi T](#). Lung ultrasound and CXR for detecting pneumonia in an acute geriatric ward. [Medicine \(Baltimore\)](#). 2016 Jul;95(27):e4153.

Carraro E, Cook C, Evans D, Stawicki S, Postoev A, Olcese V, Phillips G, and Eiferman D. Lack of Added Predictive Value of Portable Chest Radiography in Diagnosing Ventilator-Associated Pulmonary Infection. 2014; *SURGICAL INFECTIONS* 15(6)

Esayag Y, Nikitin I, Bar-Ziv J, Cytter R, Hadas-Halpern I, Zalut T, Yinnon AM. Diagnostic Value of Chest Radiographs in Bedridden Patients Suspected of Having Pneumonia. *The American Journal of Medicine* 2010; 123 (1)

Palazzetti V, Gasparri E, Gambini C, Sollazzo S, Saric S, Salvolini L, et al. Chest radiography in intensive care: an irreplaceable survey? *Radiol Med (Torino)*. 2013 Aug;118(5):744-51.

AGEING
THE GOLDEN
OPPORTUNITY

50th
AAG
CONFERENCE

08 - 10 NOVEMBER 2017
CROWN PERTH, WESTERN AUSTRALIA



AAG
Australian
Association of
Gerontology

QUESTIONS

**AGEING:
THE GOLDEN
OPPORTUNITY**

50th
AAG
CONFERENCE

08 - 10 NOVEMBER 2017
CROWN PERTH, WESTERN AUSTRALIA



AAG
Australian
Association of
Gerontology