Chapter 27

SARS: Geriatric Considerations

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SARS: Geriatric Considerations

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Studies on SARS in Old Age

Since the emergence of severe acute respiratory syndrome (SARS) as a new infectious disease in southern China in November 2002, and its subsequent spread to Hong Kong in February 2003 and then worldwide,[1] the Hong Kong Geriatrics Society has shared the clinical experience of geriatricians on SARS in elders locally[2-8] and internationally.[9-13] The Society has alerted the public and medical professionals of the atypical presentations and management issues of elderly patients and the impact of SARS on elders.[14-16]

This review is based on studies of SARS in old age in Hong Kong[3,4,7,11,17-24] (Tables 27-1, 27-3 and 27-5) and in Beijing[25-29] (Tables 27-2, 27-4 and 27-6), as well as on case reports of the atypical presentations of SARS in elders,[3,4,7,8,10-12,14,21,23,30-39] some of which were associated with outbreaks in Hong Kong, Singapore and Canada. Since elders vary considerably in their health status, the results of the studies on the presentations and outcomes of elderly SARS have to be interpreted with reference to their epidemiological characteristics, especially the comorbid diseases and fitness, or frailty, of the elders studied. As a first approximation, the percentages of elders with one or more comorbid diseases are extracted from the studies since such data are readily available, whereas the more informative data on the type and severity of comorbid diseases are incomplete. A guide to the frailty of the elderly population studied is obtained from the percentage of nursing home residents and the degree of dependency in activities of daily living and mobility. This functional information is available from the Hong Kong studies, but not from the Beijing studies. The studies by Kong[23] and Au[24] included all of the 324 elderly SARS patients in the Hong Kong Hospital Authority SARS registry, in which the definition of clinical SARS is similar to the case definition of probable SARS by the World Health Organization (WHO)[40] and laboratory-confirmed SARS follows the WHO definition,[41] based on tests consisting of polymerase chain reaction (PCR), antibody testing and virus isolation. The patients studied by Ho et al[19] and Dai et al[3,21] represented frailer elders with higher mean ages and higher degrees of frailty and functional dependency compared with those studied by Sha,[4,11] Chan,[7,17,18] Yeung et al,[20] and Tam[22] (Table 27-1). The Beijing

Table 27-1. Studies on elderly SARS in Hong Kong: epidemiology.

Study		Sha[4, 11]	Chan[7,17,18]	Ho[12,19]	Yeung[20]	Dai[21]	Tam[22]	Kong[23], Au[24]	
		C	C	C	C	C	C	L	C
Age cutoff for elders		60	60	64	65	65	65	65	65
% Elderly SARS		14.3%	32%	9.3%	13.6%		16.3%	13.0%	18.5%
Total SARS patients		147	77	429	324	460		1,467	1,755
Patient numbers studied	E	21	25	43	44	45	75	191	324
	Y		52				385	1,276	1,431
Mean age	E	71	72.1	78.5	72.9	79.5	76.3	76.0	76.8
(range)		(62–95)	(62–87)	(64–98)	(65–96)	(68–96)	(65–97)	(65–98)	(65–100)
	Y		39.5				37.8	36.0	35.9
			(13–59)				(15–64)	(0–64)	(0–64)
Male/female ratio	E	1.10	0.92	2.31	0.91	3.50	1.03	0.87	1.15
	Y	0.57	0.52				0.77	0.68	0.73
Comorbidity*	E				70.5%		82.7%	64.4%	67%
	Y						21.3%	7.2%	7%
Frailty									
NHR	E	5%	16%	33%	7%			17%	20%
Dependent		14%			5–10%	60–70%	(45% not ambulatory)	16%	
SARS contact source									
No contact history	E	42.9%			27.3%		18%	3.7%	18%
	Y	60%					20%		11%
Community acquired†	E	14.3%			38.6%		33%	24.6%	20%
	Y						67.5%		40%
Hospital acquired	E	42.8%		74.4%	31.8%		43%	69.6%	58%
	Y						12%		44%
Nursing home acquired	E			9.6%	2.3%		6%	2.1%	3%
	Y						0.5%		

*Comorbidity = percentage with one or more co-existing disease. †Community acquired source include Amoy Gardens-related exposure. E = elder (those ≥ the age cutoff used in the study); Y = young (those < the age cutoff); C = clinical SARS; L = laboratory-confirmed SARS; NHR = nursing home resident.

studies[25-29] (Table 27-2) all used the lower age cutoff of 60 years to define elders; their proportion of elderly SARS varied from 6.3% to 21.7%, and the elderly SARS patients studied were younger, with lower mean ages compared with the Hong Kong studies.

Table 27-2. Studies on elderly SARS in Beijing: epidemiology.

Study		Cao[25]	Xu[26]	Chen[27]	Li[28]	Huang[29]	
Age cutoff for elders		60	60	60	60	60	
% Elderly SARS		19%	6.3%	9.3%	21.7%	18.63%	
Total SARS patients		146	680	429	304	220	
						CW	W
Patient numbers studied	E	24	34	40	66	19	22
	Y	53	646	40	238		
Mean age	E	69.6	–	70	69.7	69.7	72.1
(range)		(60–82)	(60–76)	(60–90)	(60–84)	(62–83)	(63–86)
	Y	33.6			44.2		
			(13–59)		(18–59)		
Male/female ratio	E	1.67		0.82	1.13	1.71	1.75
	Y	1.65			0.97		
Comorbidity*	E	62.5%	23.5%		87.9%	63.2%	91%
	Y	9.4%	14.2%		34%		
SARS contact source							
No contact history	E	50%		10%	56%		
	Y	60%					
Community acquired	E				29%		
Hospital acquired	E				15%		

*Comorbidity = percentage with one or more co-existing disease. E = elder (those ≥ the age cutoff used in the study), Y = young (those < the age cutoff); CW = combined Chinese and Western medicine treatment; W = Western medicine treatment.

Epidemiology

The age distribution of SARS patients among four Asian countries is shown in Figure 24-1 on page 6.[10] The 70-plus age group accounted for 21.1%, 14.5%, 6.3% and 4.6% of the total SARS cases in Taiwan, Hong Kong, Singapore and China, respectively. The wide variation in the proportion of elderly SARS patients among these four Asian countries may be related to differences in population demographics, variations in exposure of elders to SARS (such as different hospital utilization patterns by elders, varying ratios of city to rural elderly population, differences in proportion of elders on institutional long-term care), and differences in depths of diagnostic pursuits among elders.

Of the 1,755 clinical SARS patients reported in Hong Kong during the SARS epidemics in the year 2003, 324 were aged over 65 years, and 65 of these were nursing home residents.[13,23] Analysis of the age-specific risks of SARS (Figure 27-1A)[10,23] revealed two peaks: a younger peak and an older peak. Elders (aged over 65) were over-represented among the SARS victims compared with the total population in Hong Kong (18.5% versus 11.7%), and their risk of contracting SARS was 1.58 times that of the general population (0.041% versus 0.026%). This risk rose with age and frailty (Figures 27-1, A and B), being twice and five times that of the general population for elders aged over 75 (0.054%) and for nursing home residents (0.131%), respectively.[10,13,23] This is consistent with the higher risk of infections in old age reported in the literature[42-45] and is attributable to: reduced immunity related to ageing, disease and drugs; increased risk for iatrogenesis and nosocomial transmission in both acute and long-term care facilities; and adverse social circumstances. Thus, the risk of pneumonia in those aged over 75 years was estimated as twice that of those aged 60–74 years[46] and, in residents of long-term facilities, was reported as four to 10 times that of community-dwelling older adults.[47,48]

The Hong Kong data showed a slight male predominance (male/female = 1.15) for elderly SARS patients,[10,23] in contrast to a female predominance (male/female = 0.73) for the younger SARS patients. This was probably related to the predominance of younger female healthcare workers and older male patients with chronic lung disease among the SARS victims. The age-specific incidence revealed that males were at higher risk for SARS among elders (0.076% for males aged 75 or above), while the reverse was true for younger adults (Figures 27-1A and B).[10,23] The Beijing studies[25,28,29] also revealed more males among elderly SARS patients.

The majority of the clinical SARS patients in Hong Kong had their contact source from hospital, the proportion being higher for elders compared with younger adults (58% versus 44%).[23] For SARS among nursing home residents, 81% were hospital acquired and 14% were acquired in nursing homes.[23] Because the presentations of SARS in old age could be non-specific, a positive contact history might be the first important clue leading to a diagnosis of SARS in an elder with unexplained illness during the SARS epidemic.[7] However, 18% of clinical SARS in elders had no known contact source, compared with 11% for the young.[23] While a known contact source had a high sensitivity (96%) in detecting laboratory-confirmed SARS for both the old and the young, it carried a lower positive predictive value for laboratory-confirmed SARS in the old compared with the young (62% versus 95%).[23]

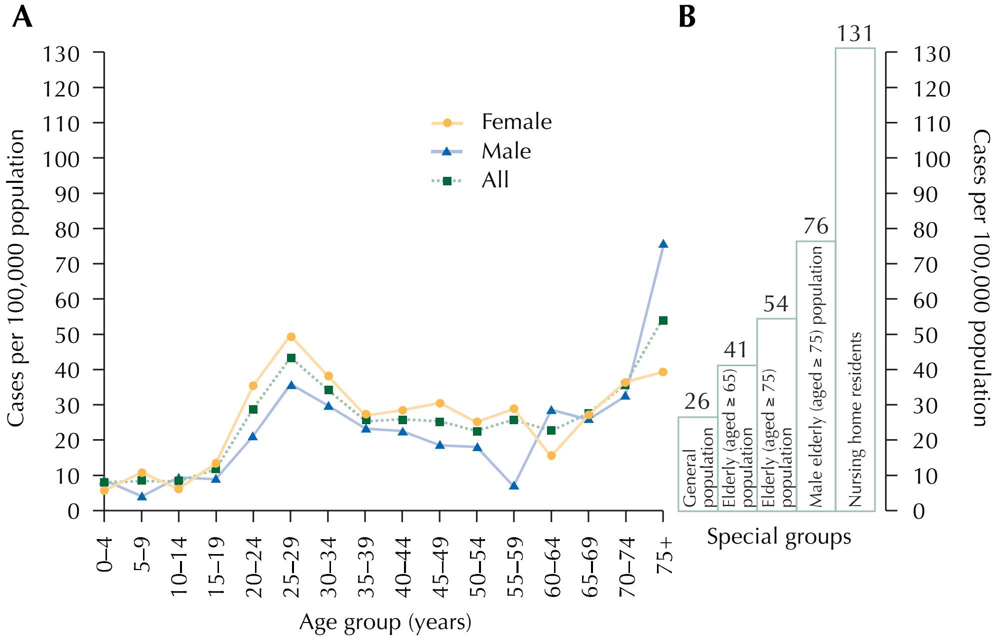

Figure 27-1. SARS case rates in specific groups (per 100,000 population in respective group) in Hong Kong, 2003.

(A) Age-sex specific. (B) Special groups: general population, elderly population (aged ≥ 65, ≥ 75, male aged ≥ 75, nursing home residents). Data derived from Hospital Authority, Statistical and Social Welfare Departments, Hong Kong.[10,13,23]

The incubation period of an infection, defined as the number of days between exposure and the onset of symptoms,[49] is characteristic of a specific infection and is, thus, often used to support or refute the diagnosis of that infection. The incubation period for SARS has been quoted as between 2 and 10 days.[41] However, the timing of exposure and symptom onset was often ill-defined in frail elders (Figure 27-2). Multiple exposures might occur because of their frequent need for hospital care, and for close personal and nursing care. The lack of a fever response and the non-specific geriatric presentations might result in a delayed detection of onset by a clinician, so that the incubation period calculated might appear longer (Figure 27-2). An incubation period longer than the quoted maximum of 10 days has been observed in some frail elders infected with SARS.[3,4,8,21] One study of an outbreak of SARS reported an apparently long incubation period of 14–21 days.[3,21] This apparently long incubation period among frail elders has important clinical implications[8,15,16] with regard to diagnosis, contact tracing, surveillance for SARS contacts and silent transmission.[21] Meltzer, using computer simulation, described a spreadsheet-based method to estimate the incubation period for patients infected with SARS with multiple contact dates, and came up with a non-normal distribution (Figure 27-3), in which a small percentage of case patients could have incubation periods over 10 days.[50] He cautioned that public health officials need to understand the degree of variability associated with incubation periods, and warned that sole reliance on the mean incubation periods will hide more than is shown, which increases the probability of failed public health interventions. Based on a cohort analysis of the clinical and radiological presentations of frail elders infected with SARS, Dai et al has hypothesized a masked phase I disease to account for the observed long incubation period of up to 14–20 days.[21] A total of 46.5% of their patients presented at diagnosis with phase II disease and desaturation and, thus, posed a risk as 'silent shedders' during the undetected phase I disease. Also, the biphasic pattern of fever corresponding to the first two phases of SARS may mislead the clinician into thinking that a fever is responding initially to antibiotics during the early course of the undiagnosed SARS, only to discover elderly SARS in the second phase when the fever kicks up again.[3,21]

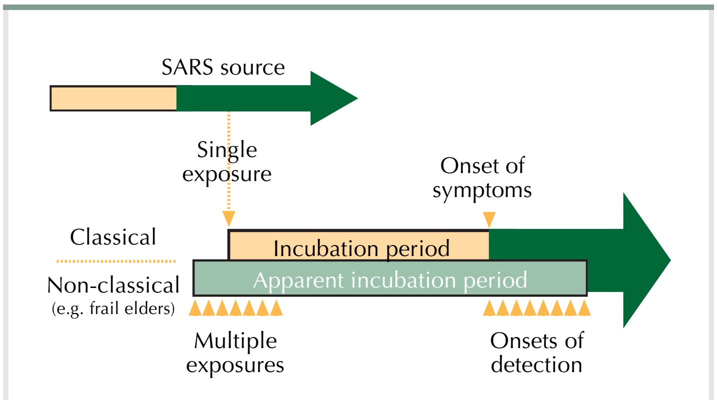

Figure 27-2. Timeline of determinants of incubation period, showing its limitations for elders.[8,10,23]

Presentation

Of the 1,755 clinical SARS patients in Hong Kong, the proportion with laboratory confirmation was lower in the old compared with the young, being 59% and 89%, respectively, reflecting a higher level of diagnostic uncertainty among the old.[23] Laboratory confirmation of SARS might not be feasible when elders died early without the collection of second serology, and might not be pursued among the frail old when the victims were gravely ill in the setting of intensive care or palliative care, or when they belonged to clusters of hospital outbreaks.

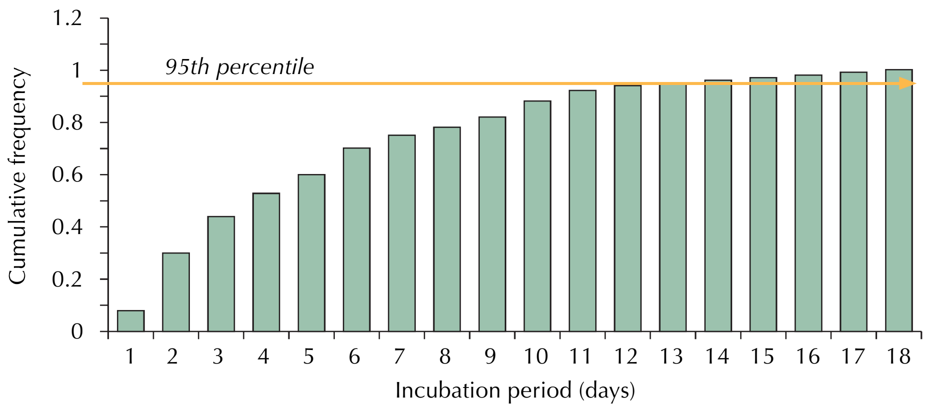

Figure 27-3. Cumulative frequency of the incubation period of SARS. Data are the mean frequencies of each individual incubation period from computer simulation of SARS data obtained from Canada, Hong Kong and the USA, for a sample size of 19; many of the patients included in the database had multiple possible incubation periods.[50]

Autopsies have revealed three more laboratory-confirmed SARS cases, all elders, to the SARS registry, but autopsies might not be readily pursued among elderly victims.[23] Comparing the old with the young, the combination of known SARS contact source, first temperature of at least 38°C and the presence of cough or dyspnoea had a lower sensitivity (19% versus 32%) and positive predictive value (61% versus 88%) in detecting and predicting laboratory-confirmed SARS.[23] Thus, the WHO case definition for suspected SARS[40] has its limitations when applied to the clinical care of individual elderly patients.

A body temperature of at least 38°C is required in the WHO SARS case definition.[40,41] Reports in Singapore[33,35] of nosocomial and nursing home transmission arising from elderly SARS patients with presentation temperatures below 38°C have questioned the sensitivity of using the temperature of 38°C as a screening tool. A similar warning has also been expressed by geriatricians in Hong Kong.[15,16] Older SARS patients were less likely to have a fever above 38°C at presentation compared with younger patients (Tables 27-3 and 27-4).[18,23,27] Of all the laboratory-confirmed SARS patients in Hong Kong, the first temperatures of 60.7% of elder patients (Figure 27-4A)[23] were at or above 38°C, compared with 79.9% of young patients (Table 27-3).[23] It was also found that nursing home residents (indicating a degree of frailty) had a lower first temperature compared with elders residing in their own homes[23]

(Figure 27-4B). A Beijing study also concluded that elderly SARS patients had significantly more low-grade fever compared with the young.[27] This absent or sluggish fever response to infections among elders has been described in the literature,[51-53] and has been attributed to impaired immune/inflammatory response in old age,[42,54,55] though others have also pointed to the under-detection of fever during sepsis in elderly patients because of lack of vigilance or inappropriate body temperature recording.[53,56,57] Careful and continual monitoring has enabled the detection of a fever response, though often delayed,[53] to infections among elders. While only 54.5% of elderly SARS patients had a temperature of over 38°C on the first day of hospitalization, 77.2% had this temperature by the third day.[20] Nevertheless, in Hong Kong 10.5% and 5.8% of the clinical and laboratory-confirmed elderly SARS patients, respectively, were 'afebrile' throughout hospitalization by the 38°C definition. In detecting febrile response in old age, it may be necessary to rely on a change in temperature rather than on the absolute temperature, because some elders may have a low baseline temperature.[58,59] Careful review of the temperature charts of 'afebrile' SARS patients uncovered in some this pattern of blunted rise in body temperature from a low baseline recording, with a corresponding rise in pulse rate.[8,23] In one study of elderly SARS, while only 55% had a temperature of over 38°C at

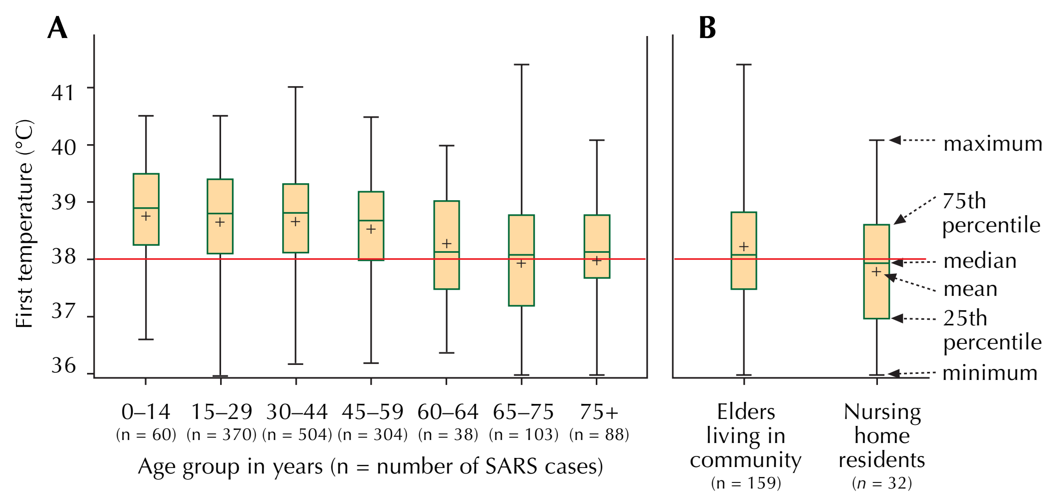

Figure 27-4. **High-low box plot of first temperature of laboratory-confirmed SARS patients in Hong Kong.**

(A) By age group (n = 1,467). (B) By resident status (n = 191).[23]

Table 27-3. Studies on elderly SARS in Hong Kong: presentation.

Study		Sha[4,11]	Chan[7,17,18]	Ho[12,19]	Yeung[20]	Dai[21]	Tam[22]	Kong[23]	
		C	C	C	C	C	C	L	C
Fever (> 38°C)	E	88.2%	56%	83.7%	54.5%			60.7%	59.0%
	Y		88%					79.9%	78.6%
Cough	E	50%	32%	44.2%	50%	11.1%	25.3%	41.8.0%	41.9%
	Y		37%				41.8%	47.0%	49.0%
Dyspnoea	E		36%	39.5%	27.3%	46.4%	25.3%	37.1%	40.1%
	Y		17%				10.6%	23.0%	23.4%
Diarrhoea	E		4%	11.6%	6.8%	7.1%	5.3%	21.3%	16.8%
	Y		21%				13.8%	26.6%	26.2%
Poor feeding	E		20%	4.7%	29.5%				
	Y		0%						
Confusion	E				6.8%	7.4%			
Fall	E				2.3%				
Reduced general condition	E		20%		4.5%	21.4%			
	Y		0%						
Lymphopenia	E	76.5%			61.4%			58.6%	59.6%
	Y							61.2%	60.3%
Abnormal chest X-ray	E	82.4%			97.3%				

E = elder (those ≥ the age cutoff used in the study); Y = young (those < the age cutoff); C = clinical SARS; L = laboratory-confirmed SARS.

presentation, 82% had a rise in temperature of over 1.1°C above baseline temperature.[20] Some elderly patients with infectious illness may even present as hypothermia,[60] which has also been reported in a few SARS patients.[33,34] The altered fever patterns in infections in old age explain the lower sensitivities (61% in old versus 80% in young) and positive predictive values (61% in old versus 91% in young) when using the first temperature of 38°C to detect and predict SARS in old age.[23]

Studies on SARS (Tables 27-3 and 27-4) showed that cough was a more frequent symptom in the Beijing series (60–80%) compared with the older Hong Kong series (11–50%), with the frailest group having the least cough.[21] The sensitivities and positive predictive

Table 27-4. Studies on elderly SARS in Beijing: presentation.

Study		Cao[25]	Xu[26]	Chen[27]	Li[28]
Fever (> 38°C)	E	96%		75%	100%
	Y	100%		97.5%	100%
Cough	E	79%		62.5%	84.8%
	Y	49%			85.3%
Dyspnoea	E	42%	25%	10%	54.5%
	Y	21%	15%		21.4%
Diarrhoea	E	25%		10%	
	Y	15%		27.5%	
Lymphopenia	E	83%		72.5%	
	Y	40%			
Abnormal chest X-ray	E	70.8%		87.5%	100%
	Y	49.1%			100%

E = elder (those ≥ the age cutoff used in the study); Y = young (those < the age cutoff).

values of using cough to detect and predict SARS were lower in the old (42% and 59%, respectively) compared with the young (47% and 86%, respectively).[23] Dyspnoea was significantly more frequent among the older and frailer SARS patients (up to 55%) across all studies. The symptom of dyspnoea had a higher sensitivity in detecting SARS in the old compared with the young (37% versus 23%), though the positive predictive value was lower in the old compared with the young (49% versus 87%). While an elder may not complain of any cough in the presence of pneumonia,[61] tachypnoea may be a first sign of pneumonia in old age.[62,63]

The altered presentations of pneumonia in old age have been well described in the literature,[63-66] these being attributed to age- and disease-associated impairments in host defenses, which interfere with the inflammatory response to infection.[64] While the febrile response may be absent, blunted or delayed, and cough minimal, elders (especially the frail ones) may present as the geriatric syndromes: falls, confusion, incontinence, poor feeding and functional decline, or worsening of a chronic illness, such as congestive heart failure.[63-66] Pneumonic infiltrate may be absent radiologically because of initial dehydration or, when present, masked by underlying or coexisting illnesses, such as chronic obstructive pulmonary disease or congestive heart failure.[66] Examples of reports of such 'atypical' SARS included 'afebrile' SARS,[4,8,11,23,33,34] mild presentation without respiratory symptoms,[32] confusion,[3,4,7,11,23] and presentations as injurious falls to non-medical specialties such as orthopaedics (for fractures)[14,23,30,39] and neurosurgery (for head injuries).[14,23] Such non-specific geriatric presentations, in contrast to the classical pneumonic symptoms, are often incompletely recorded in hospital notes, and thus not amenable to systematic study in retrospect. Of those few elderly SARS studies examining these geriatric presentations, poor feeding was present in 20–30%, reduced general condition in 5–20%, confusion in 7% and falls in 2%.[18,20,21]

Because of the frequent occurrence of multiple pathologies in old age, the diagnosis of SARS may be masked by alternative explanations or coexistence of other illnesses. These have been exemplified by case reports of elderly SARS masked by aspiration pneumonia complicating recurrent strokes,[3,37] lung cancer with brain secondaries,[4,11] pneumoconiosis and pulmonary tuberculosis,[3] concurrent pulmonary oedema,[35] concomitant urosepsis,[34,35] comorbidities such as ischaemic heart disease, diabetes, and steroid treatment for pre-existing connective tissue disease.[33]

SARS may not necessarily present as respiratory symptoms, but instead as diarrhoea. However, the elderly SARS studies (Tables 27-3 and 27-4) revealed that this presentation was less frequent among elderly patients, which might be due to under-reporting[18] or confusion with faecal incontinence in a highly dependent elder.[14] The sensitivities and positive predictive values of using diarrhoea to detect and predict SARS were, respectively, 21% and 73% in the old compared with 27% and 91% in the young.[23]

Previous reports have noted the presence of moderate lymphopenia (absolute lymphocyte count < 1000/μL) in 54–70% of SARS patients at presentation,[67-70] and the occurrence of lymphopenia has helped to alert doctors to the possibility of SARS in those presenting

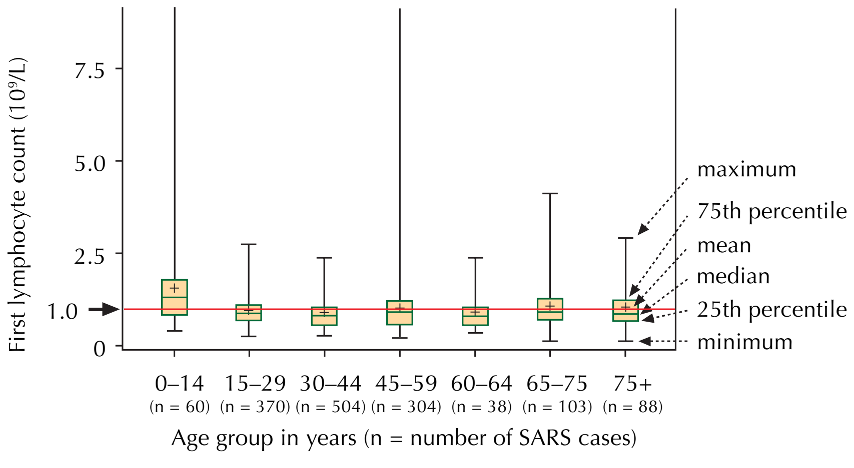

Figure 27-5. High-low box plot of first lymphocyte count of laboratory-confirmed SARS patients in Hong Kong by age group (n =1,467).[23]

atypically in epidemic areas.[33] The lymphocyte count had a wider dispersion among elderly SARS patients (Figure 27-5).[23] While lymphopenia had a similar sensitivity (60%) in detecting laboratory-confirmed SARS for both the old and young, it had a lower positive predictive value for laboratory-confirmed SARS in the old compared with the young (58% versus 90%).[23] SARS might be over-diagnosed if other common causes of lymphopenia in old age, such as malnutrition, tuberculosis, and drugs, are ignored.[3,7]

Treatments and Outcomes

The treatment for this newly discovered SARS is understandably anecdotal without the support of controlled trials. Most SARS patients in Hong Kong were treated with ribavirin and corticosteroid,[70] with a slightly lower proportion of elders receiving such treatments (Table 27-5).[24] Compared with the young, a higher proportion of elderly SARS patients required intensive care and mechanical ventilation.[18,24] The incidence of secondary nosocomial infection was high (20–48%) among elders.[3,4,11,18] Cao et al noted that the initial prescription of broad-spectrum antibiotics in the treatment of SARS could be harmful because secondary antibiotic-resistant bacterial nosocomial pneumonia was more common.[25] In a hospital outbreak involving frail elders, complications were frequent: reduced appetite (22.7%), drop in haemoglobin > 2 g/dL (36.4%), impaired liver function (31.8%), impaired renal function (27.3%), confusion (13.6%), hyperglycaemia (31.8%), hypokalaemia (47.8%), and secondary bacterial infection (18.2%).[3]

Morbidity and mortality due to SARS were striking among elders. Patient's age was strongly associated with the outcome of SARS.[18,24,69,71-73] Studies in Canada showed that an age of 60 years and older was associated with a higher case fatality rate (CFR) (43% versus 13.2% in those below 60 years).[69] For those with SARS-related critical illness, there was a predominance of older patients, and those aged over 65 years had a higher mortality at 4 weeks after ICU admission compared with those aged below 65 (71% versus 21%).[71] Similarly, studies in Hong Kong revealed that patients aged 60 years and over had a much higher CFR, shorter time from admission to death, and longer time from admission to discharge than those younger than 60 years;[72] advanced age was correlated with high oxygen dependency, intensive care unit admission or death.[11,18,24,73] The overall CFR in Hong Kong for laboratory-confirmed SARS was 49.7% in elders aged 65 or above, and 6.3% in those younger than 65; the corresponding rates for clinical SARS were 58% and 7.9% for the old and the young, respectively

Table 27-5. Studies on elderly SARS in Hong Kong: treatments and outcomes.

Study		Sha[4,11]	Chan[7,17,18]	Ho[12,19]	Yeung[20]	Dai[21]	Au[24]	
		C	C	C	C	C	L	C
Age cutoff for elders		60	60	64	65	65	65	65
Ribavirin	E	85%	100%		100%		87%	
	Y		96%				97.4%	
Steroids	E	71%	100%		97.7%		81.7%	
	Y		96%				96.3%	
Kaletra	E	39%					15%	
	Y						10.5%	
ICU admission	E	36%	36%		43.2%		30.4%	
	Y		13.5%				21.4%	
Mechanical ventilation	E	22.7%	40%		32.0%		22.0%	
	Y		13.5%				12.7%	
Secondary nosocomial infection	E	48%	20%					
	Y		3.8%					
Mortality	E	62%	60%	65%	45.5%	70%	49.7%	58%
	Y	10.3%	7.6%				6.3%	7.9%

E = elder (those ≥ the age cutoff used in the study); Y = young (those < the age cutoff); C = clinical SARS; L = laboratory-confirmed SARS.

(Table 27-5).[24] For those who died from SARS, the median time from symptom onset to death was 20 days for those aged 65 or over, and 32 days for those younger than 65.[24] Within the elderly group, the mortality rate of laboratory-confirmed SARS rose with increasing age and frailty: 40% for those aged 65–74, 57% for those aged 75–84, 59% for those aged 85–94, and 100% for those aged 95–100; and 78.1% for nursing home residents compared with 44% for community-dwelling elders.[24] These differential mortality rates among elderly SARS patients are consistent with the experience of other studies on elderly SARS in Hong Kong (Tables 27-1 and 27-5).[3,4,11,12,20,21] Thus, the mortality rates are particularly high in outbreaks in the settings of extended care hospitals and nursing homes involving older, highly dependent and frail elders (70% dependent, 33% nursing home residents),[3,12,21] compared with SARS in younger, fitter elders with lower dependency (10% dependent, 7% nursing home residents).[20] The Beijing studies (Table 27-6) reported a wide range of mortality rates (9.4–50%) for elderly SARS (aged 60 or above), probably related to differences in fitness of the elderly groups studied (Table 27-2) or treatments received (Table 27-6).[25-29] The lowest mortality of 9.4% was reported from the group[26] with the least comorbidities (23.5%) and lowest maximum age (76), though the treatment received in this group was not stated. The group that received less ribavirin and steroid (60%)[28] also had a lower mortality (22.7% versus 33.3% and 50%) compared with the two groups[25,27] receiving more ribavirin (97.5–100%) and steroids (90%). A randomized controlled study comparing combined Chinese and Western medicine with Western medicine alone showed that the former modality of treatment was associated with a lower mortality than the latter (10.5% versus 36.4%).[29] However, the group treated with Western medicine alone had higher comorbidity compared with the combined treatment group (91% versus 63.2%), although the severity of SARS illness in the two groups was comparable.

Previous studies have alluded to the high mortality and morbidity of pneumonia[65,66] and acute viral respiratory tract infections[74-78] in old age, especially among a frail old group (such as nursing home residents) or in those presenting non-classically (e.g. when patients are afebrile), which is probably associated with poor immune response to infection and delayed recognition of infection.[78] The poorer outcome of SARS in elderly patients, reflected in their increased need for critical care, more rapid downhill course and higher mortality, is probably related to interactions of ageing, comorbid diseases, disability and frailty, delayed presentation, and treatment complications.[3,7,16,21,24] Respiratory failure and multiple organ failure are readily triggered in a frail elder with reduced organ and functional reserve.[3,21,24,26,27] However, the

Table 27-6. Studies on elderly SARS in Beijing: treatments and outcomes.

Study		Cao[25]	Xu[26]	Chen[27]	Li[28]	Huang[29]	
						CW	W
Age cutoff for elders		60	60	60	60	60	60
Antibiotics	E	38%			75.8%		
	Y	13%			70.2%		
Ribavirin	E	100%		97.5%	61.3%		
	Y	100%			81.8%		
Steroids	E	88%		82.5%	62.1%		
	Y	91%			85.7%		
Mortality	E	33.3%	9.4%	50%	22.7%	10.5%	36.4%
	Y	3.8%	0.31%		6.3%		

E = elder (those ≥ the age cutoff used in the study); Y = young (those < the age cutoff); CW = combined Chinese and Western medicine treatment; W = Western medicine treatment.

variations in reported morality rates reflect the heterogeneity of elders as a group. As elders are more vulnerable to adverse drug reactions,[79] the benefit-to-risk ratio of any given intervention may be quite different in frail elders with significant comorbidities when compared to younger adults. Since elders vary in their fitness and frailty, an individualized approach is required in treating elders with SARS, balancing the risk-benefit ratio appropriate to their condition and course of illness. There have been two isolated reports of 'spontaneous recovery' of elderly SARS patients initially thought to have community acquired pneumonia and managed with antibiotics only,[3,32] suggesting that there may be milder forms of SARS that would resolve spontaneously without the need for potentially harmful antiviral treatment.

Impacts and Implications

Though the mortality rate of SARS is higher among elders, the true impact may be even higher if the effects on functional status, which threatens independence in the old, and on psychological profile are taken into account. The adverse outcome of SARS in old age has generated anxiety and fear among elders,[80,81] with resultant restriction of social activities. A total of 59% of community dwelling elders[80] and 50–66% of nursing home residents[81] with some knowledge about SARS were afraid that they would become a victim of SARS. The infection control measures, such as mask wearing, no visiting policy, contact surveillance and isolation cut across the holistic practice in geriatric medicine, interfering with effective communications and interactions with patients, family members and carers, and with multidisciplinary professionals, as well as impeding group activities and therapies.[35] All these have a major impact on the provision of rehabilitation for those recovering from acute illness and on palliative care for dying patients.[3,16] Nevertheless, information technology has been used in a geriatric hospital in Canada on a more personal level to keep patients and families connected during SARS quarantines.[82]

Delayed or missed diagnosis of elderly SARS presenting atypically could lead to catastrophic outbreaks.[3,4,11,21,31,33-39] A 60-year-old man, who presented to a surgical ward with bloody stools and a diabetes-related foot ulcer, as well as fever without respiratory symptoms or early radiological abnormalities, and who was initially thought to have gastrointestinal bleeding with nosocomial bacteraemic *Escherichia coli* urosepsis, was the index case for an outbreak of 53 probable SARS cases in a Singapore hospital, 13 of whom died.[34-36] Another 64-year-old man, who was hypothermic and dyspnoeic with basal lung infiltrates and cardiomegaly attributed to acute pulmonary oedema complicating his pre-existing coronary artery disease, was the index case for a cluster of 24 probable SARS cases in another Singapore hospital, six of whom died.[33,34] A missed diagnosis of SARS in a 90-year-old woman, a dependent nursing home resident with multiple comorbid diseases (including vascular dementia with dysphagia, ischaemic heart disease with atrial fibrillation, and diabetes mellitus), was retrospectively traced, after her death, to be the index case of a cluster of seven SARS cases involving close family members and healthcare workers in a nursing home and hospital in Singapore.[37] She was hospitalized for dyspnoea and vomiting, but had no cough or SARS contact history; her admission fever of 38.3°C resolved the next day and she remained afebrile after antibiotics treatment for presumed aspiration pneumonia; and her radiological progression was interpreted as the result of heart failure.[37] It was only after her death that epidemiological linkage with SARS was established. An 87-year-old nursing home resident was the index case of a cluster of seven SARS cases which spread from a hospital to the community, in particular, a nursing home in Hong Kong.[12,31] Two elderly patients, afebrile at presentation, one with confusion and the other with dyspnoea thought to be due to central nervous system infection and aspiration pneumonia, respectively, were implicated as the source of an outbreak involving 14 healthcare workers.[4,11] Resurgence of SARS in Toronto at the end of May 2003 has been linked to a missed SARS diagnosis for a 96-year-old man thought to have post-operative pneumonia while being treated for a fractured pelvis in an orthopaedic ward and subsequently transferred to a rehabilitation facility.[38,39,83] This Canadian outbreak, involving four Toronto hospitals (both acute and rehabilitation), remained undetected for 4 weeks after the death of the index case and resulted in a second wave of 118 SARS cases in greater Toronto.[83] Previous literature has also highlighted the impact of undiagnosed infectious illness in the frail elderly resulting in outbreaks of tuberculosis, parainfluenza and multi-drug resistant pneumococcal pneumonia.[84-86]

The publicized reports of ‘masked’ or ‘invisible’ SARS in elders have aroused much fear and anxiety among elders, the public and healthcare workers, especially those taking care of elderly patients. In a survey, the majority of the staff and healthcare workers of a nursing home expressed worries about contracting SARS and the fear of a SARS outbreak in the nursing home.[81] However, elders were more often the victims of SARS rather than the prime source of SARS. The SARS epidemic curve (Figure 27-6A) showed that elders were affected later by SARS than the young during the epidemic and, among elders, less ambulatory nursing home residents acquired the infection later than community dwellers (Figure 27-6B). In fact, many elders acquired the infection during hospital contact.[13,24] However, when such

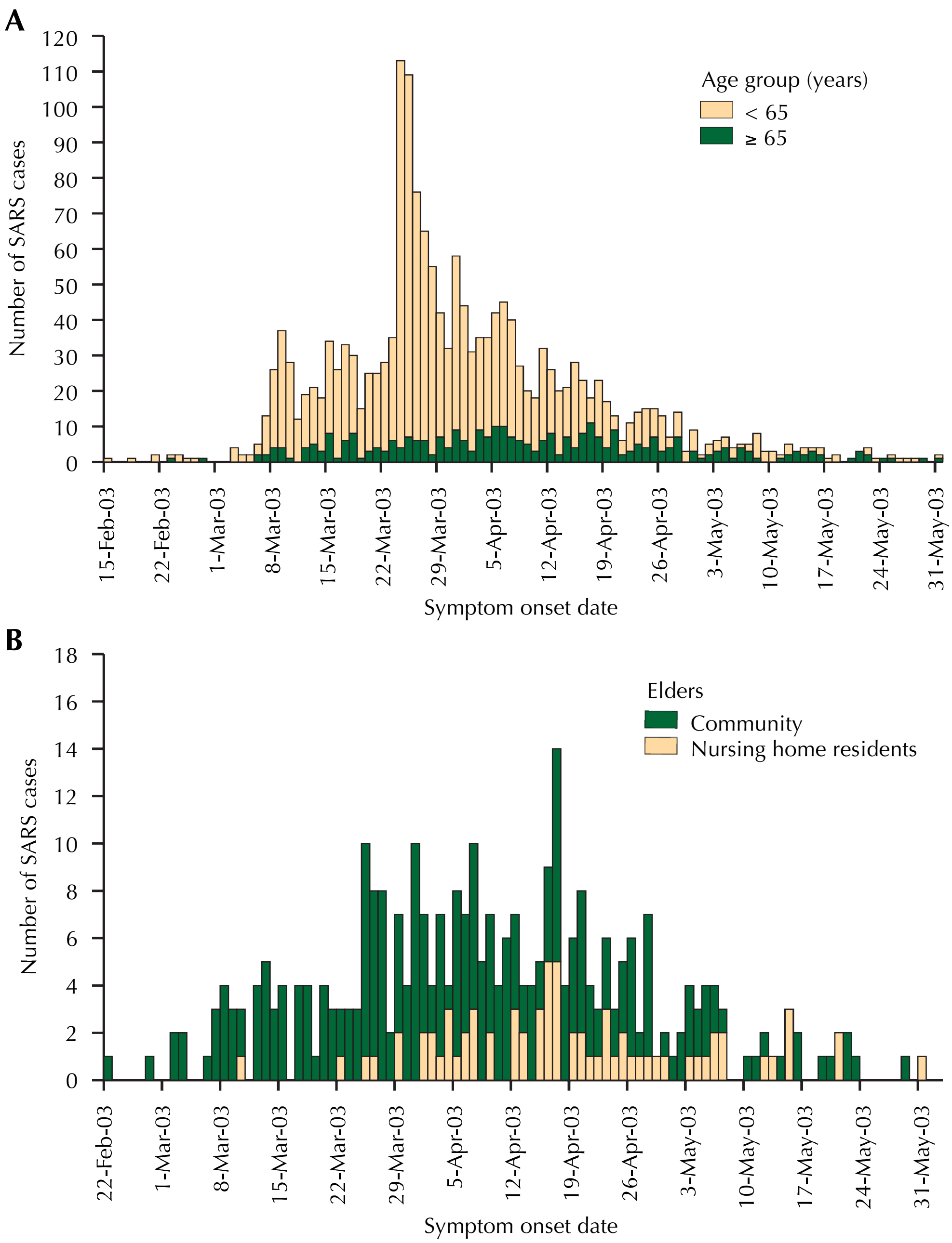

Figure 27-6. SARS epidemic curve in Hong Kong.

(A) For young and old.[24] (B) For elders living in the community and nursing home residents.[13]

infected elders were not detected early because of non-classic presentations, they became the secondary source for further spread.

How common were these non-classical presentations? Figure 27-7A is a plot of the frequency curve of the distribution of the first temperature of laboratory-confirmed SARS patients in Hong Kong. For simplicity, the first temperature cutoff of 38°C is used to separate those presenting classically from those presenting non-classically (this is just a conceptual illustration; other 'classic' defining criteria, such as incubation period, etc, can also be used). Although elders who presented non-classically appeared as outliers or 'atypical' relative to the general population, they were no longer outliers when referenced to the elderly population, i.e. non-classic presentations became more common among elders. While the majority of elders did present classically, a significant proportion presented non-classically with geriatric presentations (Figure 27-7B) discussed previously, and if these were not recognized early, disastrous consequences could occur. Even a limited number of undetected cases can have important implications for the healthcare system, as demonstrated by the large outbreaks

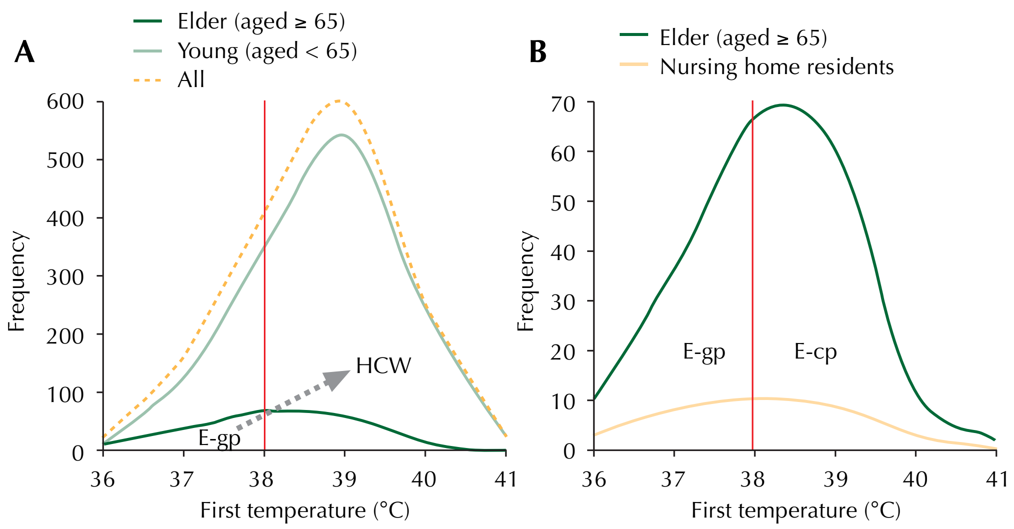

Figure 27-7. **Detecting SARS in different populations (plotted as frequency curves of first temperature of 1,467 laboratory-confirmed SARS cases in respective groups) using a temperature cutoff of 38°C.**[23]

(A) For young and elders. (B) For elders and nursing home residents. E-cp = elders with classic presentations of infection (fitter group); E-gp = elders with non-classic geriatric presentations (frailer group), who may infect (arrow) healthcare workers (HCW) if undetected.

arising from single index cases of SARS discussed above. Those elders who presented non-classically tended to be those with multiple comorbid diseases and on multiple drugs — complex patients with many things wrong rather than one thing wrong at once. They were characterized by failure to integrate response in the face of stress or frailty. Thus, when ill, they tended to present as functional decline and the geriatric syndromes such as fall and confusion, reflecting failure of the highest order functions of a complex system.[87] A singular organ-focused approach (e.g. attending to fractures and head injuries from falls, investigating for brain pathology in a confused patient) might distract the clinician from an underlying disease such as SARS.[23] Patients with multiple problems and pathologies could not be expected to show change on a single scale, and this became important when a frail elder with pneumonia presented 'atypically' without fever or cough or radiological changes. In those circumstances, tracking the physical and mental functions became sensitive, though non-specific, signs of disease.

The healthcare system needs to be geared towards these 'atypical presentations', which are actually common and 'typical' in the frail old.[87] This calls for the involvement of geriatricians and careful observations on change in physical, functional and mental states in an elder afflicted with illness, as well as appropriate diagnostic work-up, both to avoid under-diagnosis, which leads to further spread, and over-diagnosis, which may result in missing other treatable diseases, anxiety and fear associated with isolation, and overtreatment. A retrospective study has shown that two-thirds of elderly patients referred for suspected SARS had alternative diagnosis, compared with one-third in younger patients.[20] Tuberculosis, for which the last global alert was issued by WHO[88] and which is a common infection in old age, might be misdiagnosed as SARS.[7] Drug treatment of these frail elders with multiple comorbidities could hardly be guided by evidence base since typical drug trials do not test whether a drug is still likely to be better than placebo if it is, for example, the ninth and not the third drug to be added to a patient's regimen.[87] Interventions, especially pharmacological interventions, must anticipate interactions and have to be individualized.

Nursing home residents constitute an important group of frail elders (Figure 27-7B) worthy of special attention. They are prone to exposure to SARS because of their frequent need for hospital and medical service, and their need for close personal and nursing care by healthcare workers. As 81% of SARS cases among nursing home residents were hospital acquired,[23] unnecessary and inappropriate hospitalizations should be avoided, and their medical needs met by community and out-reach care as far as possible. One geriatric unit made use of telemedicine to maintain medical consultation to nursing homes during the SARS epidemic.[89]

Both Hong Kong and Singapore have implemented multisectoral collaboration preventive measures in combating SARS in nursing homes,[13,90] including training on proper infection control practices, use of personal protective equipment, cohorting and surveillance of nursing home residents recently discharged from hospitals during the SARS epidemics, and community geriatric specialist support to visiting medical officers of nursing homes to minimize hospitalization. However, nursing homes vary in their quality, with some being substandard in space, hygiene and staffing,[31] and there is a need for tailored education programmes to promote awareness and prevention of SARS for both nursing home residents and staff.[81]

Conclusions

The emergence of SARS as a new transmissible disease is a timely reminder of the global interdependence of human beings of whatever country and age. Because of the ageing population and the increasing consumption of medical and hospital services by the older age group, prevention of infectious disease is especially important for elderly patients. They are at risk for a higher age-specific rate of infection and a more severe course of illness with functional impact or fatality; there is also the potential for diagnostic uncertainty and the impact of spread from undiagnosed cases. This calls for a healthcare system that can meet the diagnostic challenge, special needs and complexity of frail elders, as well as providing continuity of care from community to hospital, and from acute to rehabilitation to long-term care.

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