CCS Consensus Conference 2003: Assessment of the cardiac patient for fitness to drive and fly – Executive summary

Primary Panel
Chris Simpson MD (Co-Chair), Kingston, Ontario;
David Ross MD (Co-Chair), Edmonton, Alberta;
Paul Dorian MD, Toronto, Ontario;
Vidal Essebag MD, Montreal, Quebec;
Anil Gupta MD, Brampton, Ontario;
Robert Hamilton MD, Toronto, Ontario;
Stephen Hart MD, Fredericton, New Brunswick;
Barry Hoffmaster PhD, London, Ontario;
George Klein MD, London, Ontario;
Andrew Krahn MD, London, Ontario;
Peter Kryworuk LLB, London, Ontario;
L Brent Mitchell MD, Calgary, Alberta;
Paul Poirier MD, Quebec, Quebec;
Heather Ross MD, Toronto, Ontario;
Magdi Sami MD, Montreal, Quebec;
Francois Sestier MD, Montreal, Quebec;
Robert Sheldon MD PhD, Calgary, Alberta;
Chris Soder MD, Halifax, Nova Scotia;
Jim Stone MD, Calgary, Alberta;
Jan Surkes MD, Langley, British Columbia;
Claude Thibeault MD, Montreal, Quebec;
Michael Tyrrell MD, Saskatoon, Saskatchewan;
Andreas Wielgosz MD, Ottawa, Ontario

Secondary Panel
Jawed Akhtar, David Borts, Joanne Braithwaite (for the Saskatchewan Government Insurance Medical Review Unit);
Eric Cohen, Louise Costa (Driver Improvement Office, Ontario Ministry of Transportation);
Jack Hirsh, Henryk Kafka, Joel Niznick, Neil Swirsky, Mario Talajic, Daniel Tessier (VP Public Affairs, Canadian Automobile Association);
Guy Tremblay

C Simpson, D Ross, P Dorian, et al. CCS Consensus Conference 2003: Assessment of the cardiac patient for fitness to drive and fly — Executive summary. Can J Cardiol 2004;20(13):1313-1323.

Nearly every Canadian physician is called on from time to time to assess the fitness of a patient to either drive a motor vehicle or fly in an aircraft. Cardiac patients comprise a distinct group of patients who frequently require such an evaluation. In fact, many Canadian jurisdictions have legislated mandatory physician reporting requirements for drivers who may be unfit to drive for medical reasons.
These guidelines aim to serve both physicians and policy-makers who must assess the fitness of cardiac patients to drive and fly. As much as possible, they are derived from scientific principles and objective assessments of risk. Summary tables of recommendations, organized by disease or condition, are presented.

Key Words: *Arrhythmias; Cardiac disease; Heart failure; Motor vehicle accidents; Public policy; Syncope*

La conférence consensuelle 2003 de la SCC : L'évaluation de l'aptitude de conduire ou de piloter du patient cardiaque

Pratiquement tous les médecins canadiens sont appelés de temps à autre à évaluer la capacité d'un patient à conduire un véhicule automobile ou à piloter un avion. Les patients cardiaques représentent un groupe distinct de patients qui ont souvent besoin d'une telle évaluation. En fait, de nombreux territoires canadiens imposent aux médecins de déclarer les conducteurs susceptibles d'être inaptes à conduire pour des raisons médicales. Les présentes lignes directrices visent à aider tant les médecins que les décideurs qui doivent évaluer l'aptitude des patients cardiaques à conduire ou à piloter. Dans la mesure du possible, elles sont dérivées de principes scientifiques et d'évaluations objectives du risque. Des tableaux sommaires de recommandations, présentés par maladie ou par pathologie, sont présentés.

MESSAGE FROM THE CO-CHAIRS

Every year, the Canadian Cardiovascular Society sponsors a consensus conference. These conferences have traditionally produced documents that have served to provide guidance to the profession regarding topical or controversial issues.

This year's conference, "Assessment of the Cardiac Patient for Fitness to Drive and Fly", first convened in October 2002. Our primary panel was divided into two subgroups, the "Drive" subgroup and the "Fly" subgroup, which met separately and developed two sets of recommendations. This executive summary document is similarly organized into two major sections: "Assessment of the cardiac patient for fitness to drive", and "Assessment of the cardiac patient for fitness to fly".

This year's consensus conference has been a collaborative effort involving both physicians and nonphysician stakeholders from across Canada. We are grateful to the volunteer members of the primary and secondary panels who have worked diligently toward the creation of this document. Our hope is that these guidelines will serve as a practical aid to those involved in the assessment of cardiac patients' fitness to drive and fly.

David Ross MD
Chris Simpson MD

Correspondence: Dr Chris Simpson, Kingston General Hospital, 76 Stuart Street, Kingston, Ontario K7L 2V7. Telephone 613-549-6666 ext 3377, fax 613-548-1387, e-mail simpsonc@kgh.kari.net
Received for publication September 29, 2004. Accepted October 5, 2004

Assessment of the cardiac patient for fitness to drive: Drive subgroup executive summary

"Drive" subgroup:
Chris Simpson (Chair), Paul Dorian, Anil Gupta, Robert Hamilton, Stephen Hart, Barry Hoffmaster, George Klein, Andrew Krahn, Peter Kryworuk, L Brent Mitchell, Paul Poirier, Heather Ross, Magdi Sami, Robert Sheldon, Jim Stone, Jan Surkes

Consultants to the "Drive" subgroup:
F James Brennan MD, Susan Nickle LLB

In 1992, the Canadian Cardiovascular Society (CCS) Consensus Conference document, "Assessment of the cardiac patient for fitness to drive", was published (1). As a result of significant advances in the investigation and management of patients with arrhythmias and syncope, an update of that consensus document was published in 1996 (2). Now, seven years after that 1996 update document, the time has come once again to re-examine this very important issue.

RISK OF HARM FORMULA

The Panel acknowledges, with gratitude, the work of the previous task force that produced the 1992 and 1996 documents. Under the leadership of Dr Jim Brennan, the Panel developed the groundbreaking "Risk of Harm" formula (Appendix A), which, for the first time, allowed the assignment of a quantitative level of risk to drivers with cardiac disease. The development of this quantitative approach included a definition of the risk that society had previously considered to be acceptable. This standard of acceptable risk served as the benchmark against which all other drivers with cardiac disease could be measured.

The reader is encouraged to refer to Appendix A for the derivation of the Risk of Harm formula. Based on the available literature, it was determined that a commercial driver (eg, a tractor-trailer operator) who faces a 1% risk of sudden cardiac incapacitation (SCI) in the next year poses a one in 20,000 risk of death or serious injury to other road users or bystanders. Set as the standard, this annual one in 20,000 risk can be applied in turn to a private driver to determine the annual risk of SCI that would pose the same overall risk to society. Because private drivers spend much less time on the road, and because they drive vehicles that are less likely to cause harm in the event that an accident actually does occur, it can be calculated that a private driver with a 22% annual risk of SCI also poses a risk to society of one in 20,000. Therefore, a private driver with a 22% chance of having a sudden incapacitating event in the next year poses no greater risk to society than does a tractor-trailer driver with a 1% chance of having a sudden incapacitating cardiac event over the same time period.

The current Panel has chosen to build on the solid foundation established by the previous task force. The updated recommendations reflect new information that has become available in the literature over the past seven years, but the Risk of Harm formula remains the major assessment tool.

TABLE OF RECOMMENDATIONS

Like the previous task force, the current Panel has chosen to present the recommendations in a tabular format to facilitate easy reference. The sections in the Summary Table of Recommendations that have undergone the most change and clarification are disturbances of cardiac rhythm, syncope, congestive heart failure and hypertrophic cardiomyopathy. Other sections have undergone less extensive change. The reader is directed to the full report (available on the CCS Web site at <www.ccs.ca>) for more in-depth detail regarding these and other recommendations.

Specific recommendations for cardiac patients' fitness to drive are found in the Summary Table of Recommendations.

LEVEL OF EVIDENCE

There are no prospective, controlled studies where patients have been randomly assigned to permit or to proscribe the driving privilege, or where patients have been randomly assigned to receive or not to receive a physician's advice not to drive. Furthermore, the defined standard of risk used in this document, while sensibly derived, is arbitrary and was not based on any evidence other than what had been acceptable historically. Given that all recommendations for driving eligibility are based on a comparison with this arbitrary standard, they are based on expert opinion only. Wherever possible, best evidence was used to calculate the risks of driving, but it should be noted that the evidence itself does not support or deny driving license restrictions for cardiac patients or the mandatory reporting of such patients by their physicians.

The Panel has made an effort to consider the inherently subjective nature of society's tolerance for risk, while also applying a scientifically based risk assessment mechanism in an effort to make the recommendations not just acceptable to society, but also consistent and justifiable.

PHYSICIAN REPORTING OF CARDIAC PATIENTS WHO ARE POTENTIALLY UNFIT TO DRIVE

The Panel acknowledges that the use of these guidelines to identify drivers who may pose a risk to others is only one part of the physician's role in protecting patients and the public. Physicians are obliged to disclose this risk to their high-risk patients and to advise them not to drive. Seven Canadian provinces and all three territories have mandatory physician-reporting legislation, which requires physicians to report to the appropriate regulatory authorities all patients who may be at an increased risk when operating a motor vehicle because of a medical condition. The remaining three provinces have a discretionary reporting system, although one province (British Columbia) mandates that physicians must report patients who have been warned not to drive but continue to do so. Refer to Appendix B for a review of legislation in Canadian jurisdictions.

SUMMARY TABLE OF RECOMMENDATIONS

- Where more than one set of circumstances or conditions coexist, the more restrictive recommendation prevails, unless stated otherwise.
- These guidelines are intended to assist decision-makers regarding the fitness of cardiac patients to drive, and are not intended to diminish the role of the physician's clinical judgment in individual cases.

I. CORONARY ARTERY DISEASE

	Private driving	Commercial driving
1. Acute coronary syndromes		
ST elevation MI	1 month after discharge	3 months after discharge
Non-ST elevation MI with significant LV damage*	1 month after discharge	3 months after discharge
Non-ST elevation MI with minor LV damage*		
If PCI performed during initial hospital stay	48 h after PCI	7 days after PCI
If PCI not performed during initial hospital stay	7 days after discharge	30 days after discharge
Acute coronary syndrome without MI (unstable angina)		
If PCI performed during initial hospital stay	48 h after PCI	7 days after PCI
If PCI not performed during initial hospital stay	7 days after discharge	30 days after discharge
2. Stable coronary artery disease		
Stable angina; asymptomatic coronary artery disease	No restrictions	No restrictions
PCI	48 h after PCI	7 days after PCI
3. Cardiac surgery for coronary artery disease		
CABG surgery	1 month after discharge	3 months after discharge

**Minor left ventricle (LV) damage is classified as a myocardial infarction (MI) defined only by elevated troponin with or without electrocardiogram changes and in the absence of a new wall motion abnormality. Significant LV damage is defined as any MI that is not classified as minor. Notwithstanding any of the foregoing recommendations, angiographic demonstration of 50% or greater reduction in the diameter of the left main coronary artery should disqualify the patient from commercial driving, and 70% or greater should disqualify the patient for private driving, unless treated with revascularization. CABG Coronary artery bypass graft; PCI Percutaneous coronary intervention*

II. DISTURBANCES OF CARDIAC RHYTHM, ARRHYTHMIA DEVICES AND PROCEDURES

1. Ventricular arrythmias

	Private driving	Commercial driving
VF (no reversible cause)	6 months after event	Disqualified
Hemodynamically unstable VT	6 months after event	Disqualified
VT or VF due to a reversible cause*	No driving until/unless successful treatment of underlying condition	
Sustained VT with no associated impairment of consciousness; LVEF <30%	3 months after event; satisfactory control	Disqualified
Sustained VT with no impairment of consciousness; LVEF ≥30%; ICD has not been recommended	4 weeks after event; satisfactory control	3 months after event
Nonsustained VT with no associated impairment of consciousness	No restriction	No restriction

**Examples include, but are not limited to, ventricular fibrillation (VF) within 24 h of myocardial infarction, VF during coronary angiography, VF with electrocution and VF secondary to drug toxicity. Reversible-cause VF recommendations overrule the VF recommendations if the reversible cause is treated successfully and the VF does not recur. ICD Implantable cardioverter defibrillator; LVEF Left ventricular ejection fraction; VT Ventricular tachycardia*

2. Paroxysmal supraventricular tachycardia, atrial fibrillation or atrial flutter

	Private driving	Commercial driving
With impaired level of consciousness	Satisfactory control	Satisfactory control
Without impaired level of consciousness	No restriction	No restriction

Drivers should receive chronic anticoagulation if clinically indicated (atrial fibrillation/atrial flutter)

3. Persistent or permanent atrial fibrillation or atrial flutter

	Private driving	Commercial driving
Adequate ventricular rate control; no impaired level of consciousness	No restriction; chronic anticoagulation if clinically indicated	

4. Sinus node dysfunction

	Private driving	Commercial driving
No associated symptoms	No restriction	No restriction
Associated symptoms (sick sinus syndrome)	Disqualified until successful treatment	Disqualified until successful treatment

Continued on next page

Continued from previous page

5. Atrioventricular (AV) and intraventricular block

	Private driving	Commercial driving
Isolated first-degree AV block	No restriction	No restriction
Isolated right bundle branch block (RBBB)	No restriction	No restriction
Isolated left anterior fascicular block	No restriction	No restriction
Isolated left posterior fascicular block	No restriction	No restriction
Left bundle branch block (LBBB) Bifascicular block Second-degree AV block; Mobitz I First-degree AV block + bifascicular block	Fit to drive if no associated impairment of level of consciousness	Fit to drive if no associated impairment of level of consciousness; and no higher grade AV block on an annual 24 h Holter
Second-degree AV block; Mobitz II (distal AV block)	Disqualified	Disqualified
Alternating LBBB and RBBB	Disqualified	Disqualified
Acquired third-degree AV block	Disqualified	Disqualified
Congenital third-degree AV block	Fit to drive if no associated impairment of level of consciousness	Fit to drive if no associated impairment of level of consciousness; QRS duration ≤110 ms; and no documented pauses ≥3 s on an annual 24 h Holter

If a permanent pacemaker is implanted, the recommendations in section 6 (below) prevail

6. Permanent pacemakers

	Private driving	Commercial driving
All patients	Waiting period 1 week after implant	Waiting period 1 month after implant
	No impaired level of consciousness after implant	No impaired level of consciousness after implant
	Normal sensing and capture on electrocardiogram	Normal sensing and capture on electrocardiogram
	No evidence of pacemaker malfunction at regular pacemaker clinic checks	No evidence of pacemaker malfunction at regular pacemaker clinic checks

7. Implantable cardioverter defibrillators (ICDs)

	Private driving	Commercial driving
Primary prophylaxis; NYHA class I to III	4 weeks after implant	Disqualified†
A primary prophylaxis ICD has been recommended but declined by the patient	No restriction	Disqualified†
Secondary prophylaxis for VF or VT with decreased level of consciousness; NYHA class I to III	6 months after event*	Disqualified†
Secondary prophylaxis for sustained VT with no accompanying decreased level of consciousness; NYHA class I to III	1 week post-implant, in addition to the appropriate waiting period for the VT (see section II [1])	Disqualified†
Any event resulting in device therapies being delivered (shock or ATP), in which level of consciousness was impaired, or the therapy(ies) delivered by the device was/were disabling	Additional 6-month restriction	Disqualified†

**The 6-month period begins not at the time of ICD implant, but rather at the time of the last documented episode of sustained symptomatic ventricular tachycardia (VT), or syncope judged to be likely due to VT or cardiac arrest. For patients who have a bradycardia indication for pacing as well, the additional criteria under section II (6) also apply. All patients must be followed from a technical standpoint in a device clinic with appropriate expertise; †ICDs may sometimes be implanted in low-risk patients. Individual cases may be made for allowing a commercial driver to continue driving with an ICD provided the annual risk of sudden incapacitation is believed to be 1% or less. ATP Antitachycardia pacing; NYHA New York Heart Association; VF Ventricular fibrillation*

8. Other

	Private driving	Commercial driving
Brugada's syndrome; long QT syndrome; arrhythmogenic right ventricular cardiomyopathy	Appropriate investigation and treatment guided by a cardiologist 6 months after any event causing impaired level of consciousness	Disqualified*
Catheter ablation procedure; EPS with no inducible sustained ventricular arrhythmias	48 h after discharge	1 week after discharge

**Inherited heart diseases may sometimes be identified to pose a very low risk to patients. Individual cases can sometimes be made to allow a commercial driver to continue driving despite the diagnosis of one of these diseases, provided the annual risk of sudden incapacitation is believed to be 1% or less*

III. SYNCOPE

	Private driving	Commercial driving
Single episode of typical vasovagal syncope*	No restriction	No restriction
Diagnosed and treated cause (eg, permanent pacemaker for bradycardia)	Wait 1 week after treatment	Wait 1 month after treatment
Reversible cause (eg, hemorrhage, dehydration)	Successful treatment of underlying condition	
Situational syncope with avoidable trigger (eg, micturition syncope, defecation syncope)	Wait 1 week	Wait 1 week
Single episode of unexplained syncope	Wait 1 week	Wait 12 months
Recurrent (within 12 months) vasovagal syncope	Wait 1 week	Wait 12 months
Recurrent episode of unexplained syncope (within 12 months)	Wait 3 months	Wait 12 months
Syncope due to documented tachyarrhythmia, or inducible tachyarrhythmia at EPS	Refer to section II	Refer to section II

**No restriction is recommended unless the syncope occurs in the sitting position, or if it is determined that there may be an insufficient prodrome to pilot the vehicle to the road side to a stop before losing consciousness. If vasovagal syncope is atypical, the restrictions for "unexplained" syncope apply. EPS Electrophysiology study*

IV. VALVULAR HEART DISEASE

1. Medically treated valvular heart disease

	Private driving	Commercial driving
Aortic stenosis	NYHA class I or II	Asymptomatic
	No episodes of impaired level of consciousness	NYHA class I
		AVA ≥1.0 cm^2
		EF ≥35%
Aortic regurgitation Mitral stenosis Mitral regurgitation	No episodes of impaired level of consciousness NYHA class I or II	No episodes of impaired level of consciousness NYHA class I EF ≥35%

2. Surgically treated valvular heart disease

	Private driving	Commercial driving
Mechanical prostheses Mitral bioprostheses with nonsinus rhythm Mitral valve repair with nonsinus rhythm	6 weeks after discharge No thromboembolic complications on anticoagulant therapy	3 months after discharge No thromboembolic complications Anticoagulant therapy NYHA class I EF ≥35%
Aortic bioprostheses Mitral bioprostheses with sinus rhythm Mitral valve repair with sinus rhythm	6 weeks after discharge No thromboembolic complications	3 months after discharge No thromboembolic complications NYHA class I EF ≥35%

AVA Aortic valve area; EF Ejection fraction; NYHA New York Heart Association

V. CONGESTIVE HEART FAILURE, LEFT VENTRICLE DYSFUNCTION, CARDIOMYOPATHY AND TRANSPLANTATION

	Private driving	Commercial driving
NYHA class I	No restriction	EF ≥35%
NYHA class II	No restriction	EF ≥35%
NYHA class III	No restriction	Disqualified
NYHA class IV	Disqualified	Disqualified
Receiving intermittent outpatient or home inotropes	Disqualified	Disqualified
Left ventricular assist device	Disqualified	Disqualified
Heart transplant	6 weeks after discharge	6 months after discharge
	NYHA class I or II	Annual assessment
	On stable immunotherapy	EF ≥35%
	Annual reassessment	NYHA class I
		Annual noninvasive test of ischemic burden showing no evidence of active ischemia

EF Ejection fraction; NYHA New York Heart Association

VI. HYPERTROPHIC CARDIOMYOPATHY

	Private driving	Commercial driving
All patients	No episodes of impaired level of consciousness	LV wall thickness <30 mm
		No history of syncope
		No NSVT on annual Holter
		No family history of sudden death at a young age
		No BP decrease with exercise

BP Blood pressure; LV Left ventricle; NSVT Nonsustained ventricular tachycardia

Despite that specific legislation obliges physicians to report at-risk drivers, many physicians have misgivings about doing so. Reported reasons for this reluctance include the following:

- **The physician's role as patient advocate:** Mandatory reporting may be interpreted as not being in the patient's best interests.
- **The consequences of reporting relative to future health care:** Mandatory reporting may cause patients to withhold information vital to their care to regain or maintain their driving privileges.
- **Perceived deficiencies of the compulsory reporting mechanism:**
  - *No way to 'temporarily suspend' driving privileges:* There appears to be no mechanism in many jurisdictions to 'temporarily suspend' driving privileges for medical conditions that increase

the risk to drive for a prespecified and finite time period. Drivers may even receive notification of license suspension after the period of high risk has passed.

- *Difficulties with reinstatement of driving privileges:* There is a perception that the process is slow and cumbersome for both patients and physicians, leading to suspension periods that are longer than had been intended.

As a result, it is acknowledged that there is widespread physician noncompliance with mandatory reporting legislation. Physicians often make personal contracts with their high-risk patients not to drive, or they simply advise their patients not to drive.

EFFICACY OF MANDATORY REPORTING LEGISLATION

The quest to make the roads and highways safer for all of us is laudable. However, although removing high-risk drivers intuitively makes sense, there is surprisingly little evidence that supports mandatory physician reporting as an effective means to increase road safety. As with any intervention, all benefits, risks and costs must be considered to make a rational judgment regarding the efficacy of the intervention. Unfortunately, there remain many unanswered questions with respect to mandatory reporting, including the following:

- How many motor vehicle accidents are caused by patients with cardiac disease who have had a sudden incapacitating event? That is, what is the scope of the problem?
- Of the patients who do have a sudden incapacitating event behind the wheel, how many had been previously diagnosed with a disqualifying condition? That is, how many would have been identified by a physician-reporting scheme?
- Of patients with license suspensions, how many continue to drive anyway? That is, what is the efficacy of the intervention?
- How many patients with cardiac disease need to be removed from driving to prevent one accident? Save one life? That is, what is the 'number needed to treat'?
- What are the consequences to the physician-patient relationship and the subsequent quality of care when physicians report their patients to the Ministry or other regulatory authority? That is, what are the costs of the intervention to the physician-patient relationship?
- What are the economic, social and health (including psychological) impacts on patients whose licenses are suspended for medical reasons? That is, what are the costs of the intervention to the patient?
- How much do provinces with mandatory reporting legislation spend annually on the identification, suspension and evaluation of medically unfit drivers? That is, what are the costs of the intervention to society?
- Does a mandatory reporting system remove more unfit drivers from the roads than simple physician advice to the patient to not drive? That is, what is the incremental benefit of the intervention?
- Do drivers with cardiac disease impose limitations on themselves? That is, do they change their driving behaviour instinctively to reduce overall risk?
- How does the risk posed by drivers with cardiac illness compare with that posed by other definable groups? That is, do drivers with cardiac illness pose a greater risk than other, apparently acceptable drivers, including young and elderly drivers, drivers who work shift work, drivers who eat or drink while driving, and drivers who use cellphones?

The evidence addressing these questions is sparse. Indeed, many people believe that mandatory reporting may be doing more overall harm than good. However, the Panel recognizes that there is a societal expectation that drivers prone to sudden incapacitation, including those with cardiac disease, must have their driving privileges restricted to a level compatible with public safety. Accordingly, in the absence of more compelling evidence, our recommendations must err on the side of public safety. However, uncertainty about the efficacy of mandatory physician reporting compels the Panel to call for investigations to address these questions. The Panel also suggests that the regulatory agencies in Canadian jurisdictions that require physician reporting minimize the negative impact on patients and physicians by creating and maintaining open, transparent, accountable and timely driver evaluation mechanisms.

General recommendation 1
The Panel recommends further research to examine the efficacy and cost-effectiveness of mandatory and discretionary physician-reporting systems, as well as the economic, social, health and quality of life impact of such systems on drivers with cardiac disease and other potentially disqualifying medical conditions.

General recommendation 2
The Panel recommends that regulatory agencies in jurisdictions where physician reporting is compulsory should work toward an open, transparent, accountable and timely driver evaluation process to minimize the negative impact on drivers whose licenses are under review or suspension.

General recommendation 3
The Panel recommends that physicians practising in mandatory reporting jurisdictions recognize that current legislation indicates that the physicians' duty to report patients who may be unsafe drivers supersedes the physician's duty to an individual patient. Physicians are encouraged to err on the side of caution when considering the fitness of cardiac patients to drive.

IMPLEMENTATION

With the proliferation of practice guidelines for many diseases and conditions, it is becoming increasingly difficult for physicians to stay abreast of the current body of medical knowledge.

In an effort to reach as many physicians as possible, members of the Panel will actively execute an implementation strategy over the coming year and beyond to disseminate this report, to foster and encourage research, and to create an environment in which the recommendations can be easily accessed. The implementation strategy includes the following:

1. Presentation of the Executive Summary and Main Document at the 2003 Canadian Cardiovascular Congress.
2. Incorporation of feedback and approval of the Executive Summary and Main Document by the CCS membership and Council.
3. Completion of the full manuscript and submission for peer-reviewed publication.
4. Distribution of the Executive Summary and Main Document to provincial and territorial regulatory authorities and to the Canadian Council of Motor Transport Administrators (CCMTA).
5. Distribution of the Executive Summary and Main Document to the Canadian Medical Association (CMA) to allow for integration into the CMA guidelines.
6. Development of a PowerPoint (Microsoft Corporation, USA) presentation for use by educators.
7. Distribution of a printed handbook for distribution to the CCS membership and provincial and territorial regulatory authorities, and posting of the final version of PowerPoint slides and PDFs in a downloadable format on the CCS Web site.
8. Establishment of contact with the Family Medicine and Internal Medicine communities to facilitate distribution of guidelines.
9. Engagement of stakeholders to facilitate research initiatives.

General recommendation 4
The Panel recommends the development of a longitudinal strategy to maximize the dissemination and implementation of these guidelines and to foster research in this area.

REFERENCES

1. Assessment of the cardiac patient for fitness to drive. Can J Cardiol 1992;8:406-19.
2. Assessment of the cardiac patient for fitness to drive: 1996 update. Can J Cardiol 1996;12:1164-70,1175-82.

DEFINITIONS

MET (metabolic equivalent): One MET is the resting oxygen consumption in the seated position and is equivalent to 3.5 mL/kg/min.
Private driver: A driver who drives fewer than 36,000 km/year or spends fewer than 720 h/year behind the wheel, drives a vehicle weighing less than 11,000 kg and does not earn a living by driving.
Commercial driver: Any licensed driver who does not fulfill the above definition of a private driver.
Waiting period: The time interval following the onset of a disqualifying cardiac condition, initiation of a stable program of medical therapy, or performance of a therapeutic procedure (whichever is applicable) during which driving should generally be disallowed for medical reasons.

- Recurrence of the disqualifying condition or circumstance during this time resets the waiting period.
- If more than one waiting period applies, the longer one should be used, except where stated otherwise.

Satisfactory control (for supraventricular tachycardia [SVT], atrial fibrillation [AF] or atrial flutter [AFL] that is associated with cerebral ischemia)**:**

- *Of SVT:* Successful radiofrequency ablation of the substrate, plus an appropriate waiting period (see section II [8]), or a three-month waiting period on medical therapy with no recurrence of SVT associated with cerebral ischemia during this time.
- *Of AF/AFL:* A three-month waiting period after appropriate treatment during which there have been no recurrences of symptoms associated with cerebral ischemia. If AF is treated with atrioventricular node ablation and pacemaker implantation, or if AFL is treated successfully with an isthmus ablation (with proven establishment of bidirectional isthmus block), then the appropriate waiting periods in section II (8) apply.
- *Of sustained ventricular tachycardia (VT) with a left ventricular ejection fraction greater than or equal to 40% and no associated cerebral ischemia:* Successful ablation of the substrate plus a one-week waiting period, or pharmacological treatment plus the appropriate waiting period defined in section II (1).

Sustained VT: VT having a cycle length of 500 ms or less, and lasting 30 s or more or causing hemodynamic collapse.
Nonsustained VT: VT of three beats or more, having a cycle length of 500 ms or less, and lasting less than 30 s without hemodynamic collapse.

APPENDIX A

Risk of Harm Formula Derivation
The risk of harm (RH) to other road users posed by the driver with heart disease is assumed to be directly proportional to the following:

- time spent behind the wheel or distance driven in a given time period (TD);
- type of vehicle driven (V);
- risk of sudden cardiac incapacitation (SCI); and
- the probability that such an event will result in a fatal or injury-producing accident (Ac).

Continued on next page

Continued from previous page

Expressing this statement as Formula 1:

$$RH = TD \times V \times SCI \times Ac$$

Fewer than 2% of reported incidents of driver sudden death or loss of consciousness have resulted in injury or death to other road users or bystanders (1-4). In Formula 1, therefore, Ac=0.02 for all drivers.

There is evidence that loss of control of a heavy truck or passenger-carrying vehicle results in a more devastating accident than loss of control of a private automobile (5). Truckers are involved in only approximately 2% of all road accidents but in approximately 7.2% of all fatal accidents (3). In Formula 1, if V=1 for a commercial driver, then V=0.28 for a private driver.

There is no published standard or definition of what level of risk is considered to be acceptable in Canada even though this is crucial in the formulation of guidelines based on the probability of some event occurring in a defined time period. It was necessary, therefore, to develop such a standard.

For several years, the guidelines of the Canadian Cardiovascular Society, the Canadian Medical Association, and the Canadian Council of Motor Transport Administrators have permitted the driver of a heavy truck to return to that occupation following an acute myocardial infarction provided that he or she is functional class I with a negative exercise stress test at seven metabolic equivalents, has no disqualifying ventricular arrhythmias and is at least three months post-infarct. On the basis of available data, however, such a person cannot be assigned a risk lower than 1% of cardiac death in the next year. The risk of sudden death would be lower than this but would be at least partially offset by the risk of other suddenly disabling events such as syncope or stroke. For such a person, SCI is estimated to be equal to 0.01 in Formula 1.

It may be assumed that the average commercial driver spends 25% of his or her time behind the wheel (3). Thus, in Formula 1, TD=0.25. As indicated above, V may be assigned a value of 1 for commercial drivers and Ac=0.02 for all drivers. Substituting into Formula 1:

$$\begin{aligned} RH &= TD \times V \times SCI \times Ac \\ &= 0.25 \times 1 \times 0.01 \times 0.02 \\ &= 0.00005 \end{aligned}$$

Allowing such a driver on the road is associated with an annual risk of death or injury to others of approximately one in 20,000 (0.00005). This level of risk appears to be generally acceptable in Canada.

A similar standard may be applied to the driver of a private automobile. The average private driver spends approximately 4% of his or her time behind the wheel (TD=0.04) (6). As indicated above, for such a driver, V=0.28 and Ac=0.02. The acceptable yearly risk of sudden death or cardiac incapacitation for such a person would be calculated as follows:

$$\begin{aligned} RH &= TD \times V \times SCI \times Ac \\ 0.00005 &= 0.04 \times 0.28 \times SCI \times 0.02 \\ SCI &= 0.223 \end{aligned}$$

Thus, the private automobile driver with a 22% risk of sustaining an SCI in the next year poses no greater threat to public safety than the heavy truck driver with a 1% risk.

Finally, for the commercial driver who drives a light vehicle, such as a taxicab or delivery truck, V=0.28 and TD=0.25, placing them at a risk between that of the private driver and that of the tractor-trailer driver.

Adapted with permission from The Canadian Journal of Cardiology.

REFERENCES

1. Ostrom M, Eriksson A. Natural death while driving. J Forensic Sci 1987;32:988-98.
2. Hossack DW. Death at the wheel. A consideration of cardiovascular disease as a contributory factor to road accidents. Med J Aust 1974;1:164-6.
3. Parsons M. Fits and other causes of loss of consciousness while driving. Q J Med 1986;58:295-303.
4. Antecol DH, Roberts WC. Sudden death behind the wheel from natural disease in drivers of four wheeled motor vehicles. Am J Cardiol 1990;66:1329-35.
5. Ontario Ministry of Transportation. 1987 Ontario Road Safety Annual Report. Toronto: Ontario Ministry of Transportation, 1987.
6. Fuel consumption survey annual report: October 1981 to September 1982 and October 1982 to September 1983 [Catalogue 53-226]. Ottawa: Statistics Canada, 1987.

APPENDIX B

Regulations governing reporting of medically unfit drivers and protection for physicians

Jurisdiction	Reporting	Medical doctor protection for reporting	Legislation
Alberta	Discretionary	Protected	Motor Vehicle Administration Act, R.S.A. 1980, c. M-22
British Columbia	Mandatory if the unfit driver has been warned not to drive but continues to do so	Not protected	Motor Vehicle Act, R.S.B.C. 1986, c. 318
Manitoba	Mandatory	Protected	Highway Traffic Act, S.M. 1985-1986, c.3-Cap.H60 (consolidated to February 1998)
New Brunswick	Mandatory	Protected	Motor Vehicle Act, R.S.N.B., c. M-17, 1973 as amended by S.N.B. 1994, c. 4, s. 6
Newfoundland and Labrador	Mandatory	Protected	Highway Traffic Act, R.S.N. 1990, cH-3 as amended by S.N. 1992, c. 26, s.1
Northwest Territories (NWT)	Mandatory	Protected, unless acting maliciously or without reasonable grounds	Motor Vehicles Act, R.S. N.W.T. 1988, c. M-16
Nunavut (currently applying NWT legislation)	Mandatory	Protected, unless acting maliciously or without reasonable grounds	Motor Vehicles Act, R.S. N.W.T. 1988, c. M-16
Nova Scotia	Discretionary	Protected	Motor Vehicle Act, R.S.N.S. 1989, c. 293
Ontario	Mandatory	Protected	Highway Traffic Act, R.S.O. 1990, c. H.8
Prince Edward Island	Mandatory	Protected	Highway Traffic Act, R.S.P.E.I. 1988, cH-5
Quebec	Discretionary	Protected	Highway Safety Code, C-24.2
Saskatchewan	Mandatory	Protected	Vehicle Administration Act, S.S. 1986, c. V-2.1 as amended by the Highway and Vehicle Statutes Amendment Act 1996, c. 29, s. 35
Yukon	Mandatory	Protected	Motor Vehicle Act, R.S.Y. 1986, c. 118

Source: CMA Guidelines for Fitness to Drive, 2000

Assessment of the cardiac patient for fitness to fly: Flying subgroup executive summary

"Fly" subgroup:
David Ross (Chair), Vidal Essebag, Francois Sestier, Chris Soder, Claude Thibeault, Michael Tyrrell, Andreas Wielgosz

Clinicians are increasingly called on to advise patients with cardiovascular disease of their fitness to fly commercially, both for the patient's own personal enjoyment and in the context of interfacility transfers for medical care.

This section of the report deals with the fitness of people with cardiovascular disease to fly on commercial airlines and some related topics, including recommendations for deep venous thrombosis prophylaxis during flight and the effects of airport screening devices on defibrillators and pacemakers. It specifically does not deal with the fitness of aviation personnel to perform their duties, which is subject to recently revised Transport Canada guidelines. Those interested can view the Transport Canada guidelines at <http://www.tc.gc.ca/CivilAviation/Cam/TP13312-2/cardiovascular/menu.htm>.

In most instances, the recommendations that follow are based on expert opinion rather than data because there are limited data available (1-6). They are derived, largely, from a consensus document developed by a working group from the Canadian Cardiovascular Society and published in 1998 (1).

Additional guidelines for ill passenger travel may be found at the Aerospace Medical Association Web site at <www.asma.org>.

AIR TRAVEL AND CARDIOVASCULAR PATIENTS

Air travel imposes on cardiac patients both general stresses (eg, travelling through crowded airports, transporting luggage) and specific stresses related to the aircraft environment. Stresses specific to the aircraft environment include lowered humidity, relative confinement in a cramped space and, most important, reduced barometric pressure while in flight. In addition, medical care is relatively inaccessible to patients for the duration of the flight. Where feasible, exercise testing to determine functional capacity should be performed before determining whether a patient with cardiovascular disease is fit to fly.

Physicians should be aware that all Canadian registered aircraft with more than 100 passenger seats carry an emergency medical kit. Some airlines carry automatic external defibrillators and, as of April 2004, all American airlines are required to have one on board all aircraft with at least one flight attendant. At present, there are no plans to make defibrillators mandatory on Canadian registered aircraft. Some airlines only permit trained flight attendants to operate the defibrillators because volunteering physicians may be unfamiliar with the equipment.

SUMMARY TABLE OF RECOMMENDATIONS

I. INDICATIONS FOR OXYGEN DURING COMMERCIAL AIRLINE FLIGHTS

- Partial pressure of arterial oxygen less than 70 mmHg at sea level
- Angina functional class III symptoms
- Heart failure functional class III symptoms
- Cyanotic congenital heart disease
- Pulmonary hypertension/right heart failure

II. RECOMMENDATIONS FOR SPECIFIC CARDIOVASCULAR CONDITIONS

Condition	NYHA functional class	Travel by commercial airline
Angina pectoris	I and II	No restriction
	III	Supplemental oxygen required
	IV	Only if medically necessary and accompanied*
Post-MI	I	1 to 2 weeks for repatriation if uncomplicated and successfully revascularized or low risk on angiography/noninvasive studies
		6 to 8 weeks for elective travel
	II to IV	Only if medically necessary and accompanied*
Heart failure	I and II	Unrestricted
	III	Supplemental oxygen required
Valvular disease	I and II	Unrestricted. Supplemental oxygen suggested if pulmonary hypertensive
	III	Supplemental oxygen required
	IV	Only if medically necessary and accompanied*
Congenital	I to II	Unrestricted. Supplemental oxygen if partial pressure of arterial oxygen <70 mmHg
	III	Supplemental oxygen required
	IV	Only if medically necessary and accompanied*
Post-CABG/ valve surgery	I to II	4 days postsurgery and hemoglobin ≥90 g/L if flight <2 h†
		7 days postsurgery and hemoglobin ≥90 g/L if flight ≥2h
Therapeutic intervention – PCI/ASD closure	I to II	1 day postprocedure
		If PCI following MI, follow post-MI guidelines prevail

Continued on next page

Continued from previous page

Arrhythmia/post-arrhythmia procedure	I to II	Well-controlled supraventricular arrhythmias – unrestricted
	I to II	1 day postprocedure for supraventricular arrhythmias
	I to II	2 days postprocedure for ventricular arrhythmias
	III to IV	Uncontrolled hemodynamically significant ventricular arrhythmias should not fly by commercial aircraft
Post-pacemaker/ICD/loop recorder implant	I to II	1 day postimplant if no pneumothorax, and device functions normally and is programmed appropriately
ICD patients	I to II	1 month following last intervention from device associated with severe presyncope/syncope

**Accompanied by a physician equipped with an attached electrocardiogram monitor/defibrillator, oxygen and appropriate medication; †If hemoglobin <90 g/L and wishes to avoid transfusion, then supplemental oxygen required. ASD Atrial septal defect; CABG Coronary artery bypass graft; ICD Implantable cardioverter defibrillator; MI Myocardial infarction; NYHA New York Heart Association; PCI Percutaneous coronary intervention*

III. AIR MEDICAL TRANSPORT OF CARDIAC PATIENTS

Air medical transport of cardiac patients is increasingly performed for a combination of medical, social and economic reasons. Patients are transported by helicopter (for short distances) or by fixed-wing aircraft (for longer distances) for emergent or elective indications. Previous guidelines have only addressed unescorted commercial airline travel (3-5). While the data on air medical transport of cardiac patients are limited and mostly observational, the results of a recently published study (6) are considered in these recommendations.

Emergency helicopter transport of patients early in the course of acute myocardial infarction (MI) is considered safe, and a recent randomized trial suggested an outcome benefit (7). There are also data suggesting that long-distance emergent air transport is safe and reasonable when local care is inadequate (6). In general, provided that the air ambulance (helicopter or jet) is well staffed and equipped, it is reasonable to emergently transport a patient from a location where the level of care is less than or equal to that available on board the air ambulance.

For elective long-distance transport (eg, repatriation for economic and/or social reasons), it is important to consider the risks and benefits when deciding the timing and type (eg, medical escort aboard commercial airline versus private air ambulance) of transport. Patients who are post-MI may be transported by commercial airline earlier than the guideline recommendations for air travel if accompanied by a physician equipped with a monitor, defibrillator, medications and oxygen. Data from a few studies suggest that air medical transport by commercial airline is safe for stable patients two weeks post-MI (8-10). In cases where earlier transport is desired, air ambulances with intensive care capabilities may be used. As suggested by another study (11), it is reasonable to electively transport post-MI patients by air ambulance once they are chest pain-free for two to three days.

IV. RECOMMENDATIONS FOR DEEP VENOUS THROMBOSIS PROPHYLAXIS WITH LONG-DURATION AIR TRAVEL*

Flight <12 h – all travellers	Avoid stasis, move around cabin, isometric calf exercises Avoid dehydration, alcohol and caffeinated drinks
Flight ≥12 h – low risk	Avoid stasis, move around cabin, isometric calf exercises Avoid dehydration, alcohol and caffeinated drinks
Flight ≥12 h – moderate risk Healthy people age >75, women >45 taking estrogen-containing hormone replacement therapy, pregnant and postpartum women, people up to age 45 who are heterozygous carriers of mutations for factor V Leiden and prothrombin gene mutation, those with varicose veins, heart failure, myocardial infarction within previous 6 weeks, recent lower limb trauma within 6 weeks (12,13)	Avoid stasis, move around cabin, isometric calf exercises Avoid dehydration, alcohol and caffeinated drinks Below knee graduated pressure stockings If elastic stockings not used, ASA 160 mg to 325 mg 4 h before flight†
Flight ≥12 h – high risk History of previous VTE, recent major surgery (within 6 weeks), active malignancy, gross obesity or marked immobility due to neuromuscular or cardiorespiratory disease, people age >45 with deficiencies of antithrombin, protein C or protein S, or people age >75 with cardiac or pulmonary disease (12,13)	Avoid stasis, move around cabin, isometric calf exercises Avoid dehydration, alcohol and caffeinated drinks Below knee graduated pressure stockings If elastic stockings not used, low molecular weight heparin (4000 to 5000 anti-Xa units subcutaneously) 2 h before flight

**Literature supports 12 h as the threshold for risk of developing thromboembolism, but many would consider 9 h to be the threshold; †Data for efficacy of acetylsalicylic acid (ASA) are inconclusive. VTE Venous thromboembolism*

V. AIRPORT SECURITY SCREENING, ICDs AND PACEMAKERS

Archway style security metal detectors (those used in airport terminals, courthouses and some schools) detect metal objects by using an electromagnetic field. This type of security system should not affect the operation of implantable cardioverter defibrillators (ICDs) or pacemakers. Metal detectors in compliance with the National Institute of Law Enforcement and Criminal Justice standards generate relatively small amplitude magnetic fields, which are unlikely to affect cardiac rhythm devices.

Independent testing performed on ICDs and pacemakers from various manufacturers showed no device inhibition, inappropriate detection, or reprogramming by any of the units during a slow walk-through (10 s to 15 s). Remaining in the archway for longer periods should be avoided.

A hand-held detector wand has the potential to temporarily inhibit an ICD or pacemaker's output. Passing the wand over the ICD or pacemaker may result in a brief pause in the patient's heart rhythm. This pause may or may not be felt by the patient, and would be extremely unlikely to be harmful. More frequent movement of the detector wand over the ICD or pacemaker has the potential for causing increased interference with

device operation. If a hand-held detector wand must be used, it should not be passed over the device area more than once every 5 s. This will minimize the potential for interference with device operation.

An ICD or pacemaker patient walking through an archway metal detector may set off its alarm because the device is enclosed in a metal housing. Because the detector cannot determine the nature of detected metal objects, the patient may need to undergo a hand search for clearance. The patient should inform security personnel that he/she has an implanted cardiac device, present their identification card, and be prepared for alternative search methods.

VI. PHYSICIAN LIABILITY WHEN ADVISING PATIENTS ON THE SAFETY OF FLYING

Three situations are addressed: Good Samaritan, direct patient involvement and remote assistance.

Good Samaritan is defined as attending to a passenger in need on a volunteer, ad hoc basis, where no prior patient-physician relationship existed. There may be two concerns, one of liability by acting and the other by not volunteering to act. The former is governed by law while the latter is more likely to be addressed by medical licensing bodies (ie, the respective provincial Colleges).

There is no precedent of a physician who acted in good faith on board an aircraft as a Good Samaritan being successfully sued for malpractice. However, there is one example in case law of a successful suit against a physician, which was not related to air travel. The legal position on Good Samaritan behaviour is that the physician takes the usual measures expected of a licensed physician. If a physician has serious reservations about providing assistance either because of a lack of necessary skills or by being impaired (eg, due to fatigue, drugs or alcohol), that physician has the right to withdraw his or her service. Any mishap while impaired could result in a loss of protection in the courts.

Physicians are expected to respond to a call for assistance. Recognizing such a moral duty, a provincial College may look unfavourably on a physician who refuses assistance, considering such behaviour unprofessional. That such a refusal would find its way into a court of law is unlikely.

Direct patient involvement arises when a patient is advised about medical fitness to fly in a sanctioned doctor-patient relationship. In such cases, a physician is liable for any related adverse outcome. As long as the advice given was reasonable and reflected customary practice, such a physician can expect to be indemnified by the Canadian Medical Protective Association. Where guidelines exist, they provide a benchmark for the appropriateness of the advice that was offered.

Remote assistance relates to management advice that is offered for a passenger with whom the physician, typically on the ground, is not in direct contact. This can apply either to a patient known to the physician or to a new case. For example, a physician may be asked to provide management advice for a patient being transported to a hospital, or a medical opinion may be offered about the advisability of air evacuating a patient from a remote location, such as a foreign country.

In such cases, the physician assumes some responsibility, usually shared with any other parties that may be involved (eg, those attending to the patient directly). The advice rendered should reflect reasonable practice. Proper documentation, particularly of the information that is made available, is of paramount importance in legal defence. Information should be requested by fax or at least notes of any telephone conversations should be made.

Physicians involved in Telehealth, providing routine medical advice for flying passengers, should check with their respective licensing authorities about the validity of their practice beyond the named jurisdiction.

REFERENCES

1. Thibeault C, Kostuk WJ. Recommendations on air travel for heart patients. Perspect Cardiol 1998;14:27-56.
2. Gendreau M, DeJohn C. Responding to medical events during commercial airline flight. N Engl J Med 2002;346:1067-73.
3. Ryan TJ, Anderson JL, Antman EM, et al. ACC/AHA guidelines for the management of patients with acute myocardial infarction. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Management of Acute Myocardial Infarction). J Am Coll Cardiol 1996;28:1328-428.
4. Aerospace Medical Association Medical Guidelines Task Force. Medical Guidelines for Airline Travel, 2nd edn. Aviat Space Environ Med 2003;74(5 Suppl):A1-19.
5. Medical aspects of transportation aboard commercial aircraft. AMA commission on emergency medical services. JAMA 1982;247:1007-11.
6. Essebag V, Halabi AR, Churchill-Smith M, Lutchmedial S. Air medical transport of cardiac patients. Chest 2003;124:1937-45.
7. Grines CL, Westerhausen DR Jr, Grines LL, et al; Air PAMI Study Group. A randomized trial of transfer for primary angioplasty versus on-site thrombolysis in patients with high-risk myocardial infarction: The Air Primary Angioplasty in Myocardial Infarction study. J Am Coll Cardiol 2002;39:1713-9.
8. Cox GR, Peterson J, Bouchel L, Delmas JJ. Safety of commercial air travel following myocardial infarction. Aviat Space Environ Med 1996;67:976-82.
9. Zahger D, Leibowitz D, Tabb IK, Weiss AT. Long-distance air travel soon after an acute coronary syndrome: A prospective evaluation of a triage protocol. Am Heart J 2000;140:241-2.
10. Roby H, Lee A, Hopkins A. Safety of air travel following acute myocardial infarction. Aviat Space Environ Med 2002;73:91-6.
11. Essebag V, Lutchmedial S, Churchill-Smith M. Safety of long distance aeromedical transport of the cardiac patient: A retrospective study. Aviat Space Environ Med 2001;72:182-7.
12. Bagshaw M; The Air Transport Medicine Committee, Aerospace Medical Association. Traveller's thrombosis: A review of deep vein thrombosis associated with travel. Aviat Space Environ Med 2001;72:848-51.
13. Hirsch J, O'Donnell M, Kearon C. Indications for DVT prophylaxis with air travel. Patient Care Canada 2002;13:80-5.