CHANGE

Some Reflections on the History of Cardiology, and the RVH.

Maurice McGregor

Cardiology End -of-Term “Rounds”

12/12/13

The only advantage of being older is that you acquire a longer perspective.

My theme this afternoon is ***change.***

So for this end-of-term session I invite you to reflect with me on some of the astounding changes that have taken place in in the world, in the RVH, and in cardiology, over the last 60 years.

And since I will do this from a personal viewpoint,

let me first say a few words of self introduction.

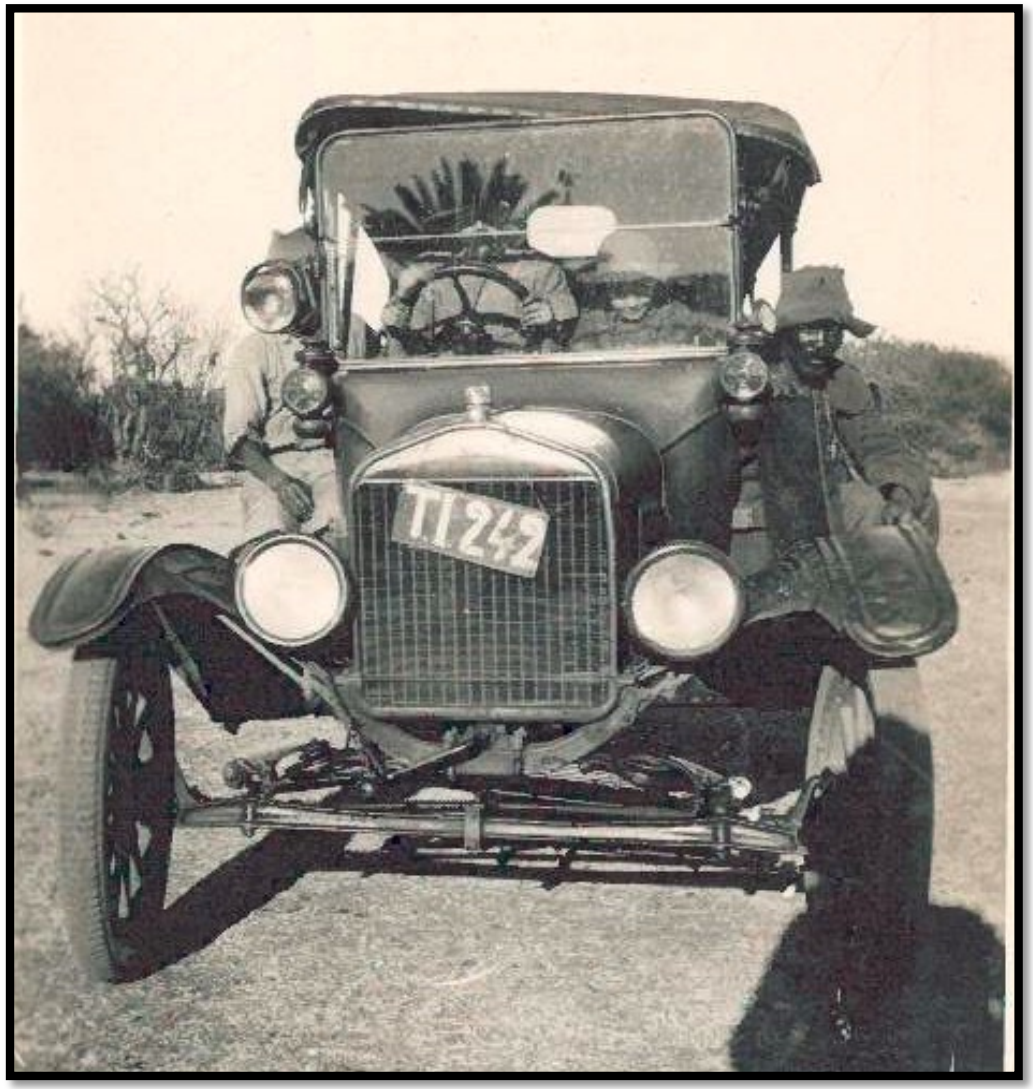
I was born in the southern end of the African continent.

This is dry country. Like Texas or southern California. When I was born there were about 7 million South Africans. Good farmland was short. Today there are about 60 million . This a amount of change in one lifetime is clearly non-sustainable. If we don't stop breeding we will run out of World to live on.

Rapid transportation was by horse or mule cart. My Mother, an Oxford graduate, is taking three visitors to the nearby village for an afternoon's shopping.

Heavy loads went by ox wagon. There were no lorries. This is our 12 ox power model.

A major change was the introduction of the automobile 1926 .This 1918 model T Ford has right-hand drive. It came from another British colony, Canada.



She was well-made and still functions well in the Eastern townships.

I did my medical training in Johannesburg. It was a six-year curriculum. Hardly anything we learned would be the slightest value today.

Antibiotics had not been conceived of. The biggest cause of death was acute bacterial infection. [This will return with increasing antibiotic resistance].

We learned how to make pills and suppositories.

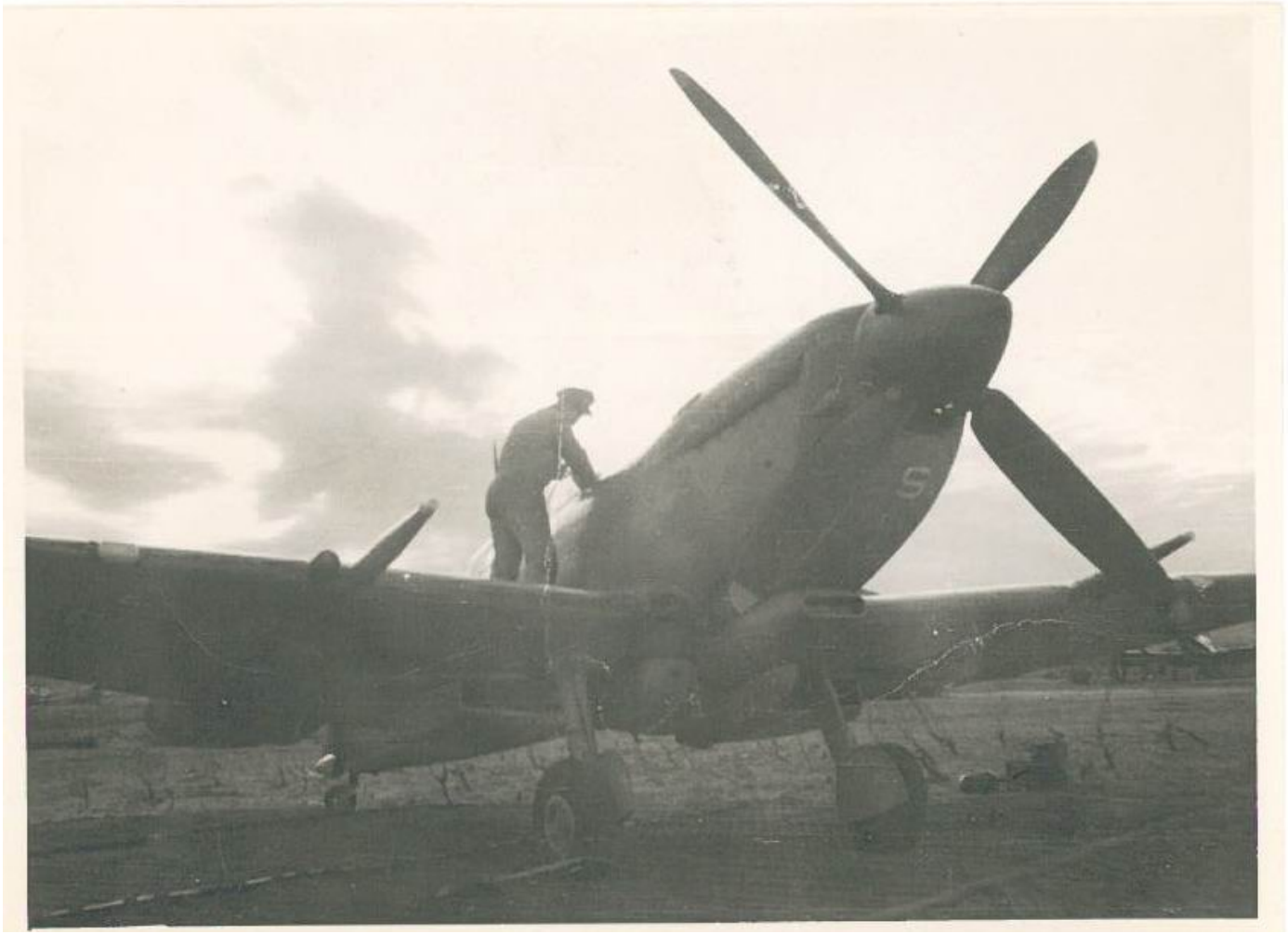
We learned 350 prescriptions from the British Pharmacopoeia. Almost all useless or harmful.

I can think of only four exceptions: aspirin, quinine, morphine and digitalis.

By the time I graduated WW II had broken out.

So I spent the next 4 years in the Army in North Africa and Italy. My first posting was that of a Medical Officer to a fighter squadron. The pilots flew Spitfires.

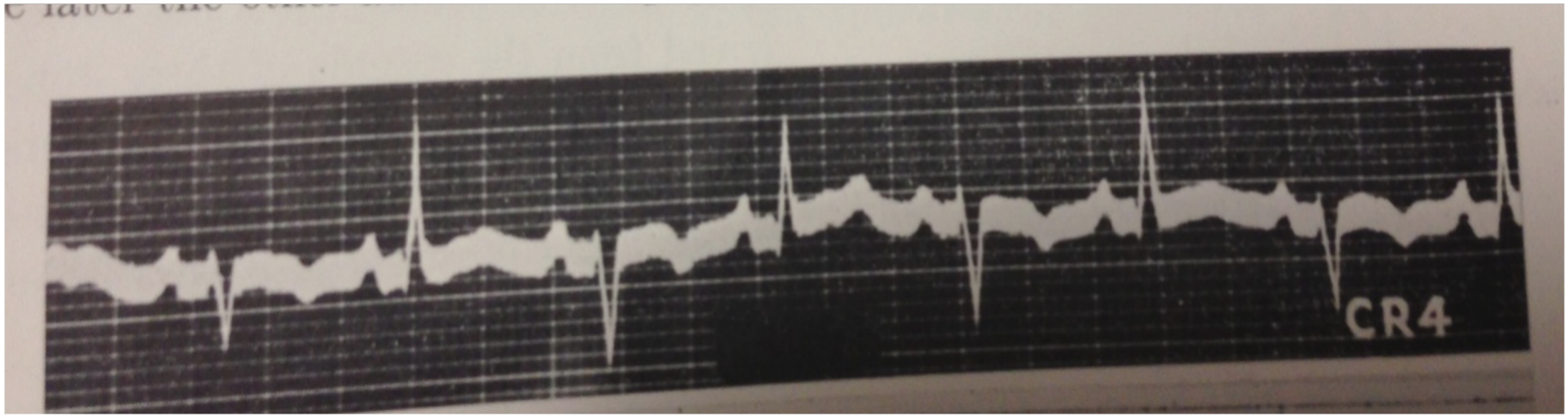
They were young and healthy. At 23 years of age I was the oldest of the two dozen officers .There was no medicine to do. Which was lucky as I had not even done an internship..



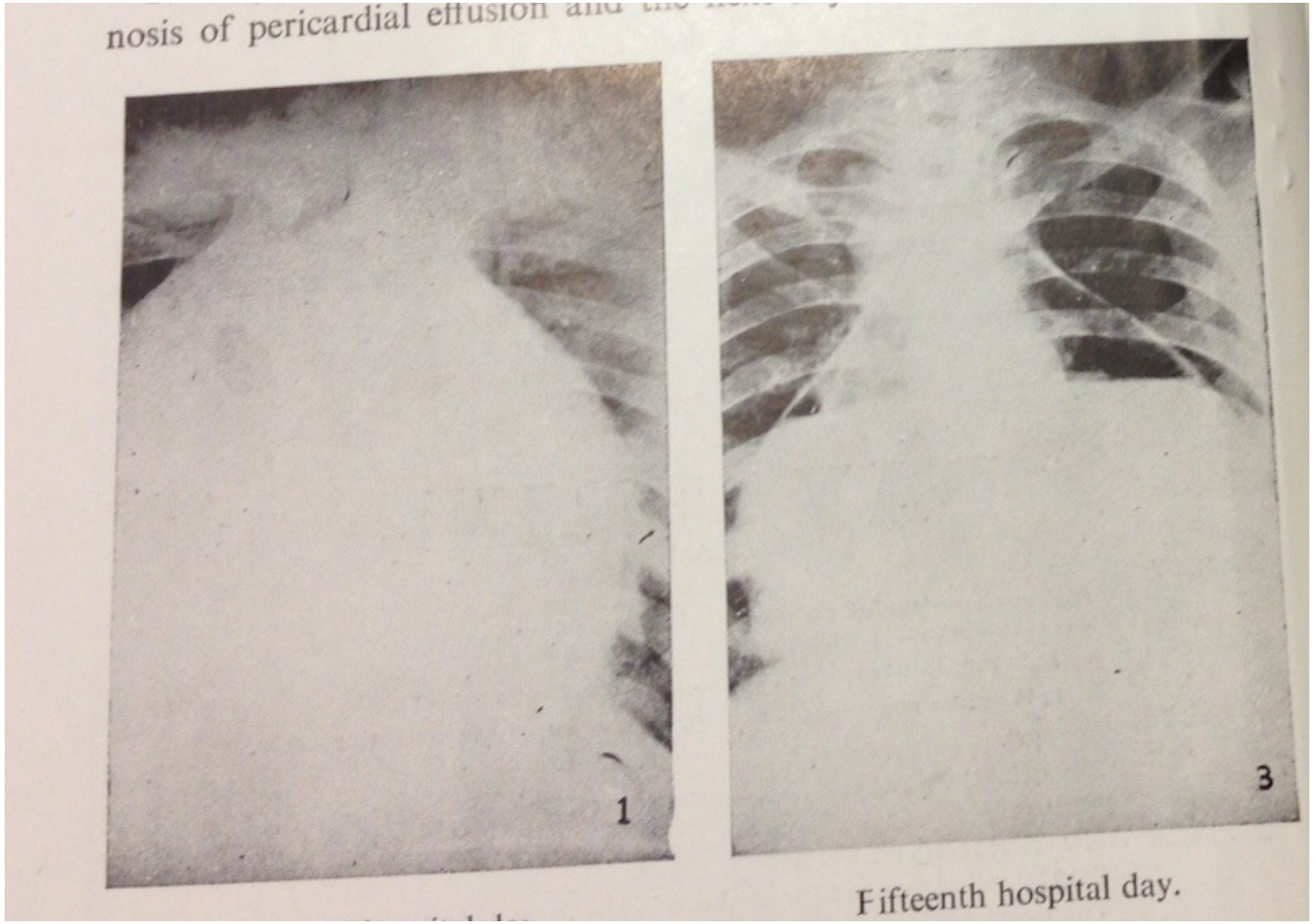
These were my patients, my pilots. They were never ill. The problem was stress. In the next 3 months 7 of these young men were shot down. Two of them had breakdowns.
The Dr, me, had to decide whether they should be classified as “operational fatigue “ or “LMF”. This was the worst sort of diagnosis I have ever had to make.

So I applied for a transfer to an infantry battalion where all I had to do was put on shell dressings, give morphine, and treat a condition called “trench foot”.

As soon as I was released from the Army I went back to SA tofrom do my internship. My first publication was a case report from which this slide is copied. (Note the Eindhoven String Galvanometer and the CR lead) Diagnosis ?



Of course, this patient had a large pericardial effusion. This allows the heart to rotate with each beat with a corresponding shift in the ECG. Several more cases turned up later which led us to describe an intriguing but fairly useless clinical sign.



Reprinted from CIRCULATION
Vol. XI, No. 6, June 1955
Printed in U.S.A.

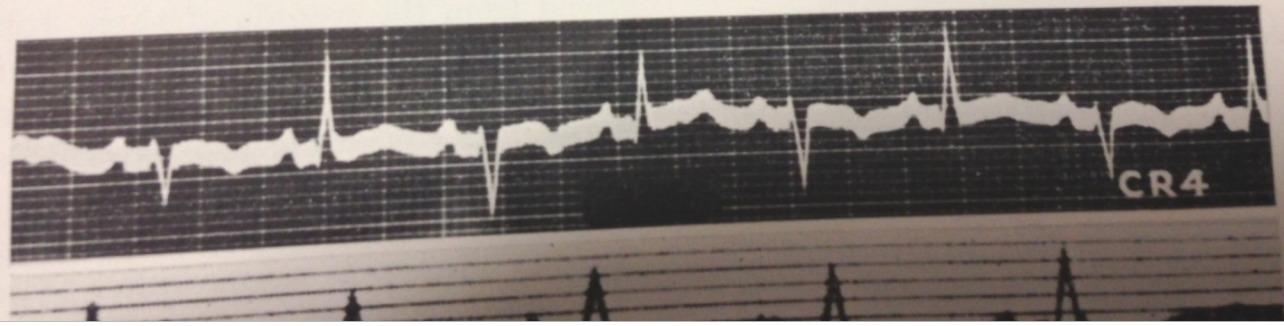
Electric Alternans in Pericardial Effusion

By MAURICE MC GREGOR, B. CH., M.D., M.R.C.P., AND EUGENE BASKIND, B.CH., M.D.

Evidence is presented which indicates that electric alternation is frequently associated with pericardial effusion; that this alternation is of a unique type; and that it is caused by movement of the heart in the fluid filled pericardial sac.

IN 1946 one of us observed and reported[1] a case of pericardial effusion with simultaneous electric alternans of the auricles and ventricles and in the following year noticed a publication illustrating the same electric phenomenon in a similar case[2] (see fig. 1A and B). Some time later the other author of this paper they arose from the free movement of the heart suspended in fluid.[3] Observations made at that time and more recently, together with a scrutiny of the cases reported in the literature, has led us to conclude, first, that there is an association between electric alternans and effusion which is more than fortuitous and

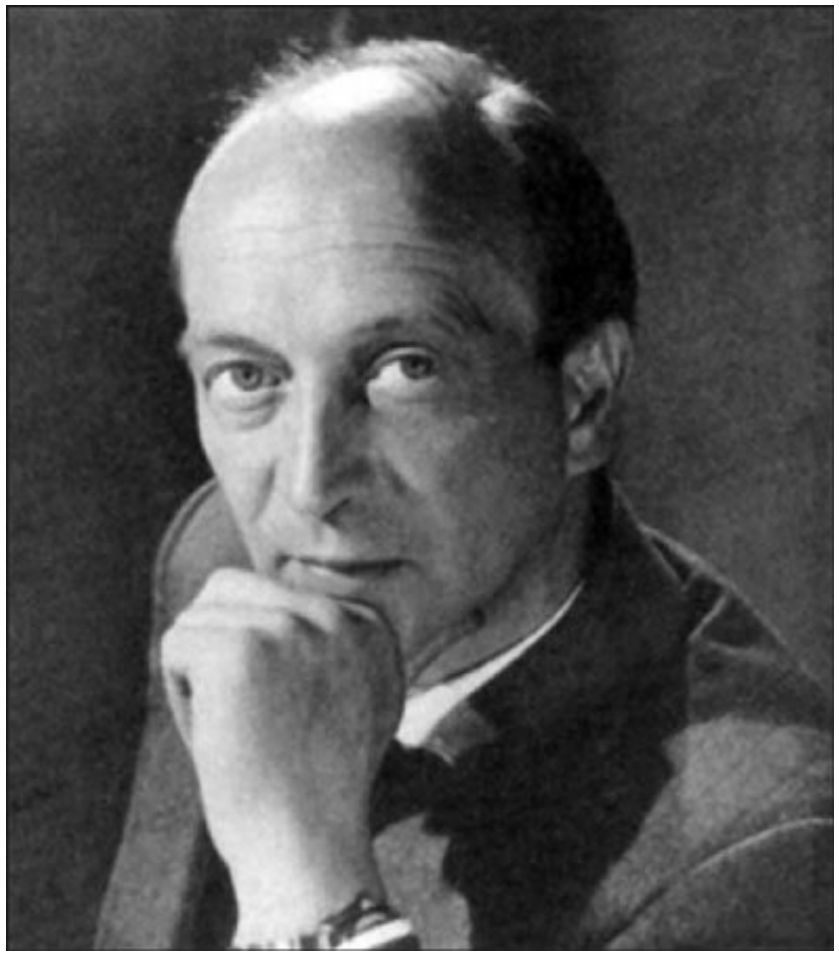
A



By Christmas 1947 I had found my way to London to do some postgraduate training. London had not yet started to recover. Since this picture was taken the rubble had been cleaned away, but that was all.

But there was a most extraordinary vitality. The war was over. The world was full of hope. Never mind a crushing War debt and a destroyed industry. In 1948 the UK brought in universal Medicare. And thousands of young British, Canadian, Australian, and American docs flocked to London to catch up for lost time.

Hammersmith Hospital, was a centre of postgraduate training. It was offering ***8 week*** internships. I was lucky to land one under a young Australian cardiologist, ***Paul Wood*** and subsequently stayed with him for 2 years as his Registrar at the Heart Hospital and the Brompton Hospital.



It was a wonderful time to enter cardiology. No one had measured pressure or flow in the normal human heart, let alone hearts affected by disease.
If any one person can be credited with leading cardiology out of the dark ages it was Werner Forssman. In 1929, this young surgeon lay down on a stretcher, anaesthetised his arm and passed a urinary catheter into his chest, and then walked to the x-ray department to guide it into his heart.

German medicine was not amused. But in 1945,16 years later, André Cournand and Dickinson Richards read about his adventure and started clinical cardiac catheterisation in New York .

The three of them received the Nobel Prize in 1956.

Two years after Cournand's publication we started catheterisation in London.
We did the procedures on the floor of the ECG Dept after regular work was over.
We made our own catheters, measured pressure with saline manometers (for which I had to study glassblowing) and we worked without x-ray guidance.

But we learned some extraordinary things. Like the normal PA pressure and the fact that it was elevated in patients with mitral stenosis. We learned the normal cardiac output, measured using the Fick principle. For the next 20 years this was what cardiovascular research was like.

After a while we moved into the x-ray department and tried our hand at contrast radiography.

In 1938 Robb and Steinberg had described angiocardiography. In 1948 it was still a primitive procedure. We would inject 60 cc Diodrast into an arm vein and expose 1 or 2 x-ray plates when we hoped it was in the heart. I took off time in the hospital workshop to make a device for doing this better. Research ?

AUGUST 1949

ANGIOCARDIOGRAPHY: A NEW CASSETTE CHANGER

By M. McGREGOR, M.D.(Rand), M.R.C.P.(Lond.)

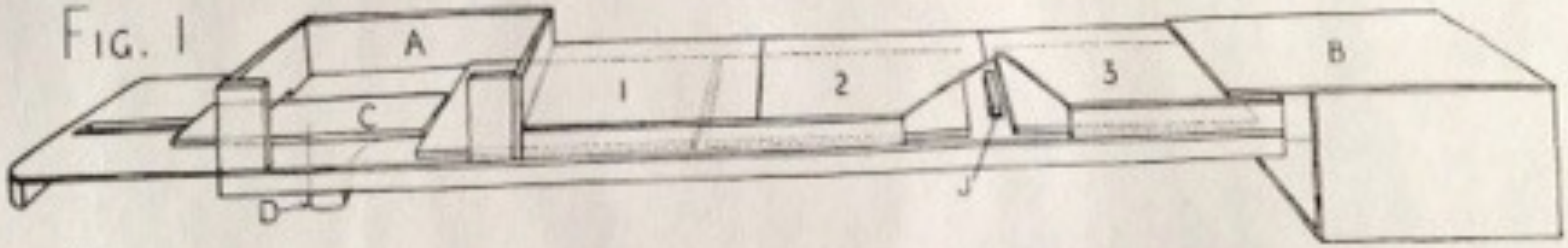
Registrar, Department of Medicine, Postgraduate Medical School of London

RECENT progress made in angiocardiography has removed it from the realm of experiment, and it is now becoming an accepted clinical procedure. In angiocardiography it is of greater value to obtain multiple exposures during the passage through the heart of the injected opaque medium than to take a single exposure at a predetermined time after injection.

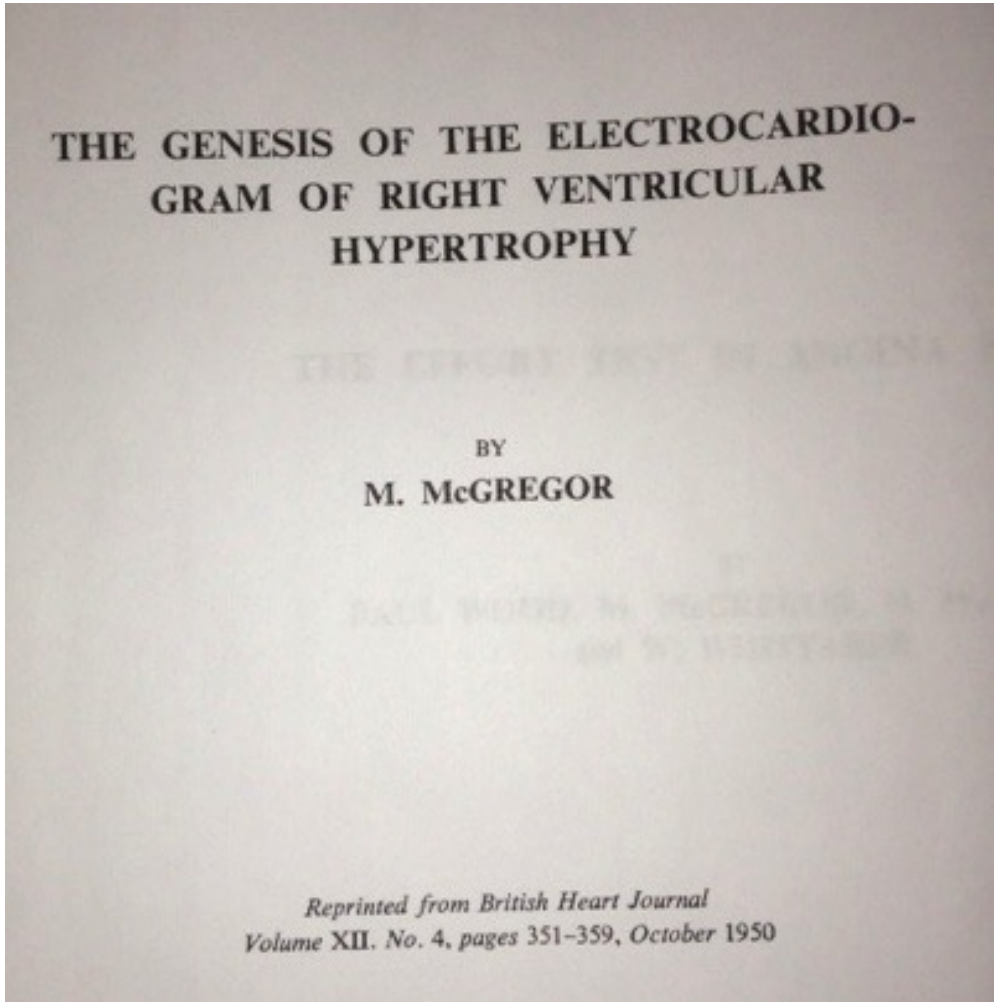
and in the hands of some workers appear to have been very highly developed (Holm, 1944; Lysholm, 1946). This apparatus, too, is likely to be expensive, and the procedure has the disadvantage that some loss of definition seems inevitable.

The simplest method consists of the rapid interchange and exposure of ordinary radiographic cassettes, and various methods of doing this have

FIG. 1



Because we knew so little, almost everything that we looked at and described was “research”. Why was there a predominant R wave at V1 in RVH ?. The long-suffering surgeons allowed us to take recordings from the heart’s surface during surgery to try to explain it.



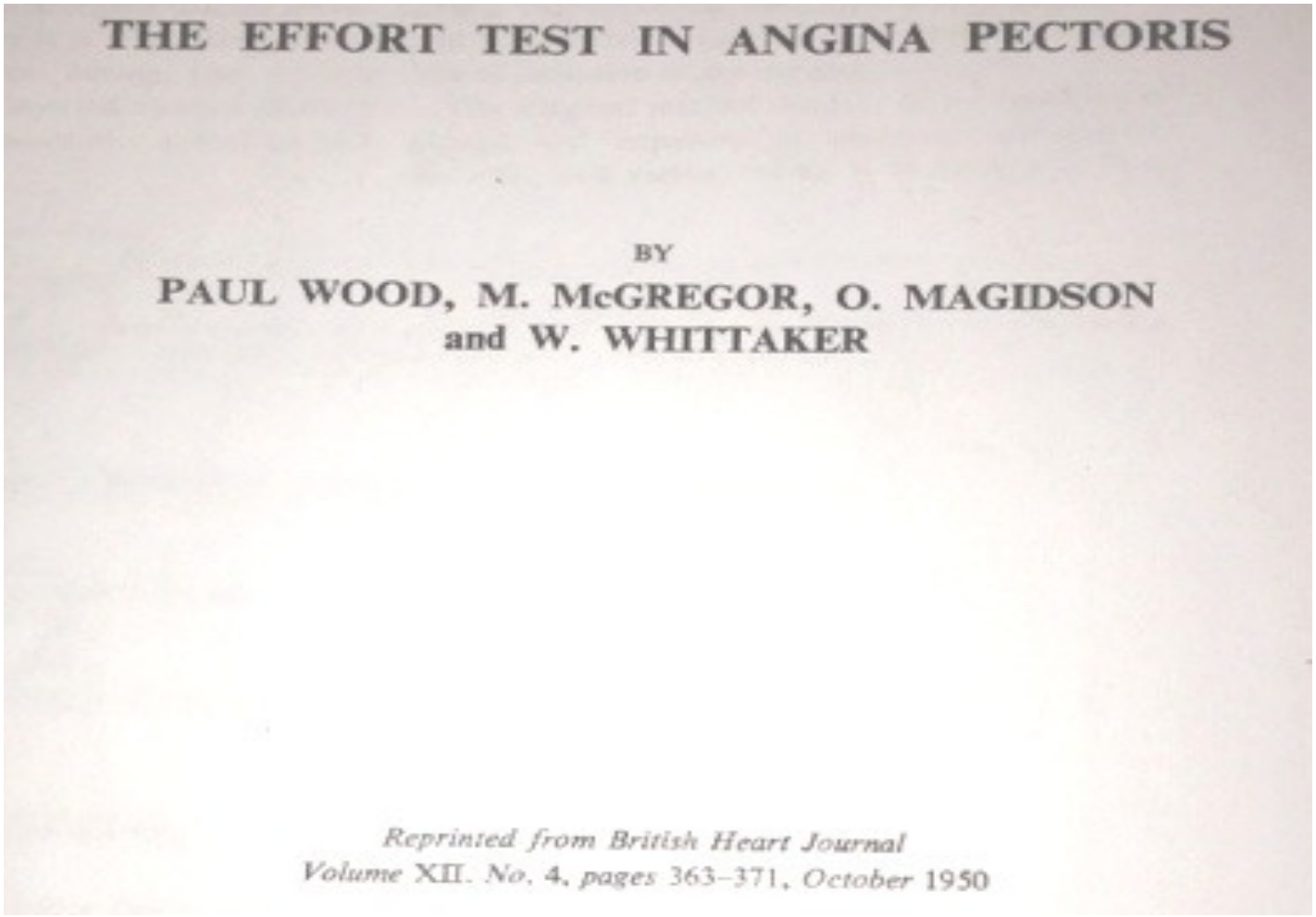
THE GENESIS OF THE ELECTROCARDIOGRAM OF RIGHT VENTRICULAR HYPERTROPHY

BY

M. McGREGOR

Reprinted from British Heart Journal
Volume XII. *No.* 4, *pages* 351–359, *October* 1950

The treadmill had not yet been invented. So we standardised exercise by counting the number of times the patient claimed up a step before getting chest pain. In this sort of “research”, funding was unknown. Which is lucky because I don’t think CIHR would have thought much of it.



THE EFFORT TEST IN ANGINA PECTORIS

BY

PAUL WOOD, M. McGREGOR, O. MAGIDSON
and W. WHITTAKER

Reprinted from British Heart Journal
Volume XII. *No.* 4, *pages* 363–371, *October* 1950

In 1950 we returned to South Africa. We improved heart catheterisation techniques and continued to describe what we found. For example conditions like Ebstein's Anomally had not yet been diagnosed in life.

Reprinted from AMERICAN HEART JOURNAL, St. Louis Vol. 43, No. 1, Pages 77-88, January, 1952 (Printed in the U. S. A.)

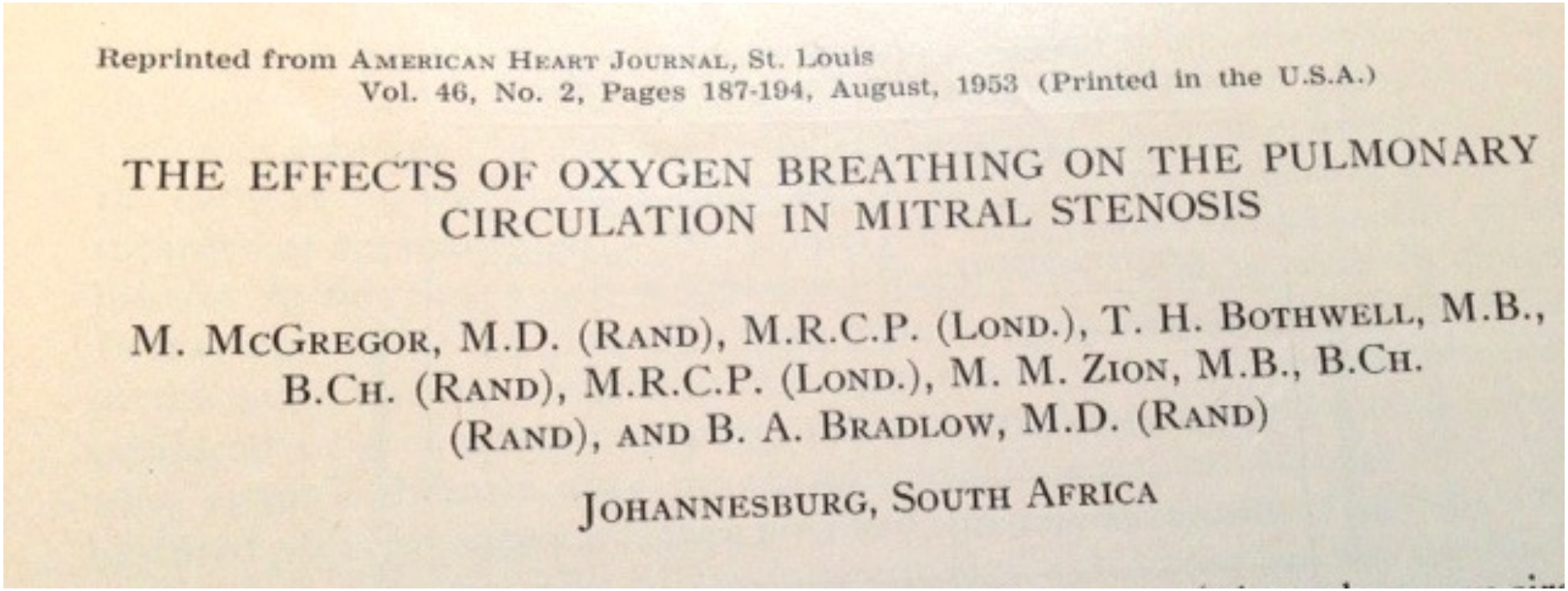
CLINICAL AND CARDIAC CATHETERIZATION FINDINGS COMPATIBLE WITH EBSTEIN'S ANOMALY OF THE TRICUSPID VALVE: A REPORT OF TWO CASES

B. VAN LINGEN, M.D., M. MCGREGOR, M.D., M.R.C.P. (LOND.), J. KAYE, M.R.C.S., L.R.C.P. (LOND.), D.M.R. (CAPE TOWN), M. J. MEYER, M.B., B.CH. (RAND), D.M.R. (LOND.), H. D. JACOBS, M.B., B.CH. (RAND), J. L. BRAUDO, M.B., B.CH. (RAND), T. H. BOTHWELL, M.B., B.CH. (RAND), AND G. A. ELLIOTT, M.D., F.R.C.P. (LOND.), F.R.S. (S.A.)

JOHANNESBURG, SOUTH AFRICA

TWENTY-TWO cases of Ebstein's anomaly of the tricuspid valve have been reported.[1] However no case has been diagnosed during life. The results

Really, all our studies were about normal and abnormal human anatomy and physiology. For example we knew very little about the effects of oxygen tension on pulmonary vascular resistance.



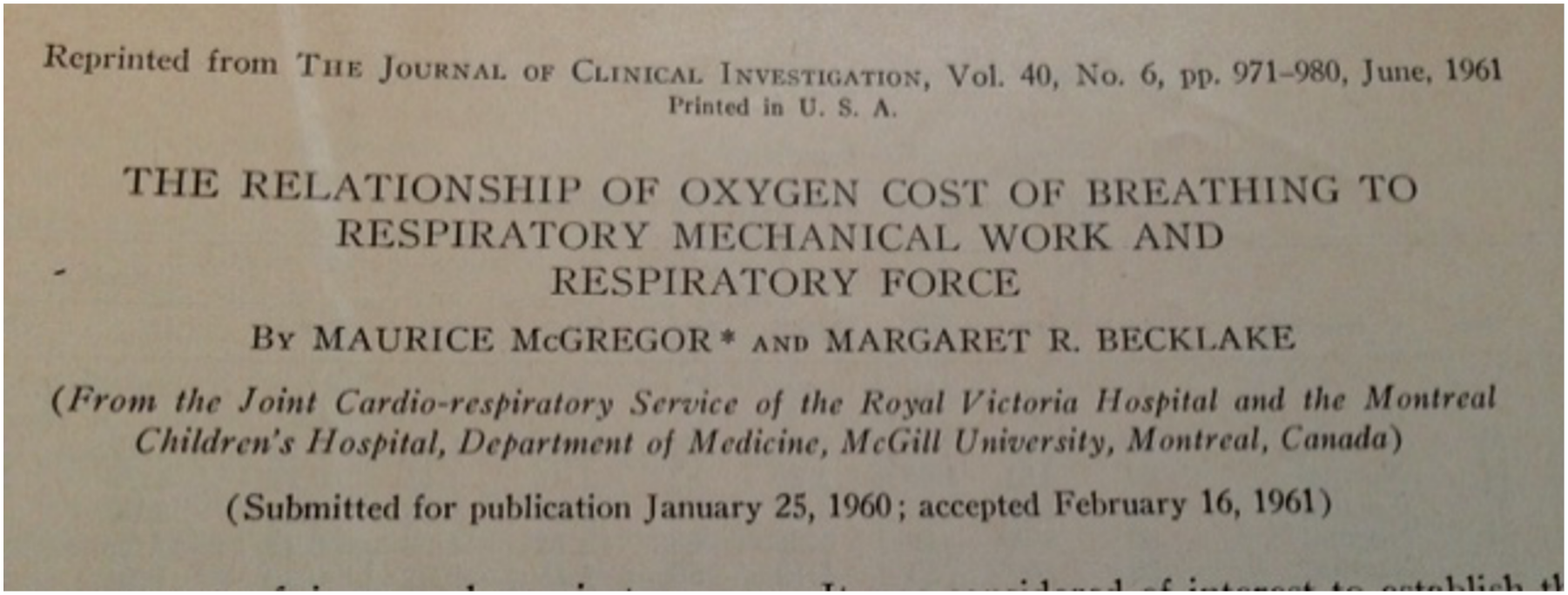
Reprinted from AMERICAN HEART JOURNAL, St. Louis
Vol. 46, No. 2, Pages 187-194, August, 1953 (Printed in the U.S.A.)

THE EFFECTS OF OXYGEN BREATHING ON THE PULMONARY CIRCULATION IN MITRAL STENOSIS

M. McGREGOR, M.D. (RAND), M.R.C.P. (LOND.), T. H. BOTHWELL, M.B., B.CH. (RAND), M.R.C.P. (LOND.), M. M. ZION, M.B., B.CH. (RAND), AND B. A. BRADLOW, M.D. (RAND)

JOHANNESBURG, SOUTH AFRICA

Most of our physiological studies were on ourselves and on patients. In this study we found that it was more meaningful to relate the oxygen cost of breeding to the tension developed rather than the work. A few studies involved other species.



Reprinted from THE JOURNAL OF CLINICAL INVESTIGATION, Vol. 40, No. 6, pp. 971–980, June, 1961
Printed in U. S. A.

THE RELATIONSHIP OF OXYGEN COST OF BREATHING TO RESPIRATORY MECHANICAL WORK AND RESPIRATORY FORCE

BY MAURICE McGREGOR* AND MARGARET R. BECKLAKE

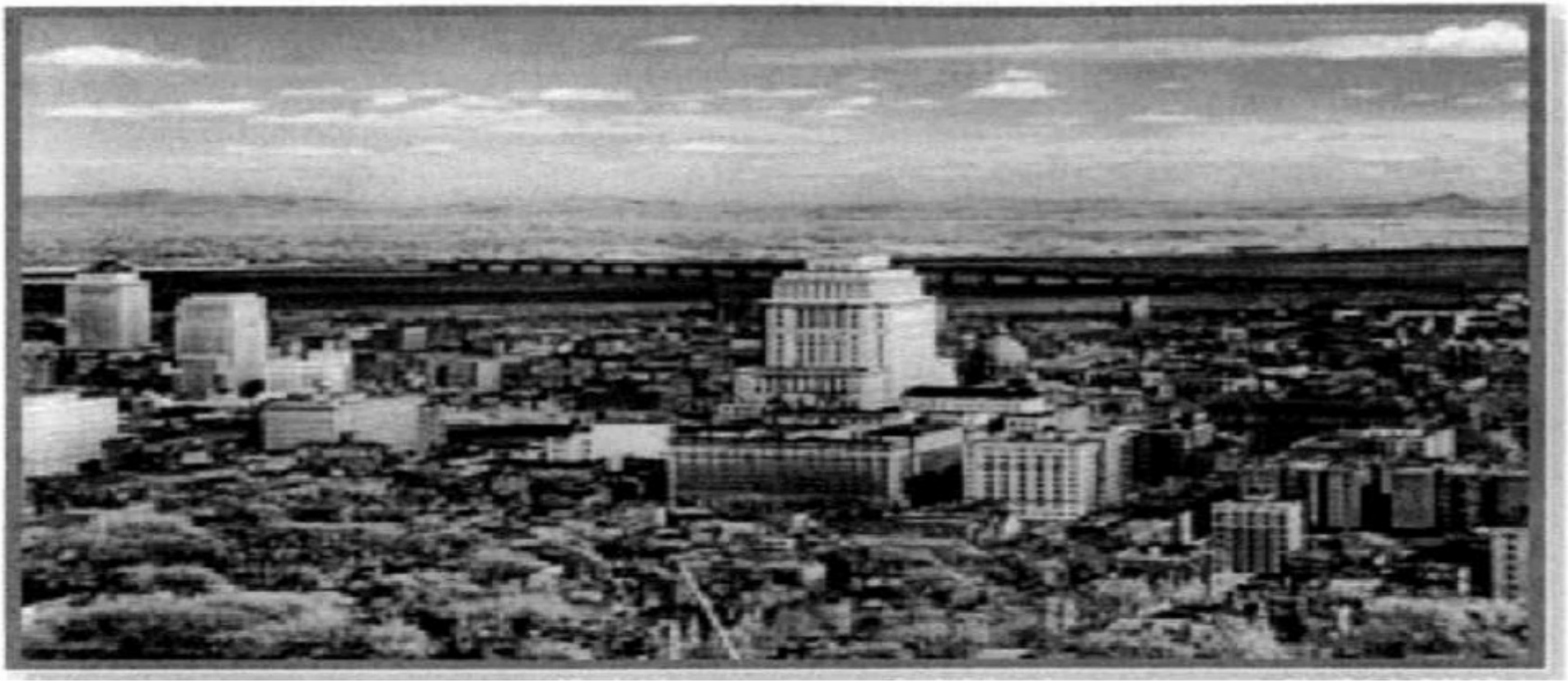
(From the Joint Cardio-respiratory Service of the Royal Victoria Hospital and the Montreal Children's Hospital, Department of Medicine, McGill University, Montreal, Canada)

(Submitted for publication January 25, 1960; accepted February 16, 1961)

In 1954 we assisted a team that catheterised some giraffes

Goetz RH, Warren JJ, Gauer OH, Patterson JL Jr, Keen EM, McGregor M. Circulation in the giraffe. Circ Res 1960;8:1049-58.

After seven years we decided to emigrate . We chose McGill. The Montréal that we arrived in in 1957 is no longer recognisable. The principal building in the city was the Sun Life .
But some things don’t change. They were talking about building a new bridge, to be called the Pont Champlain.



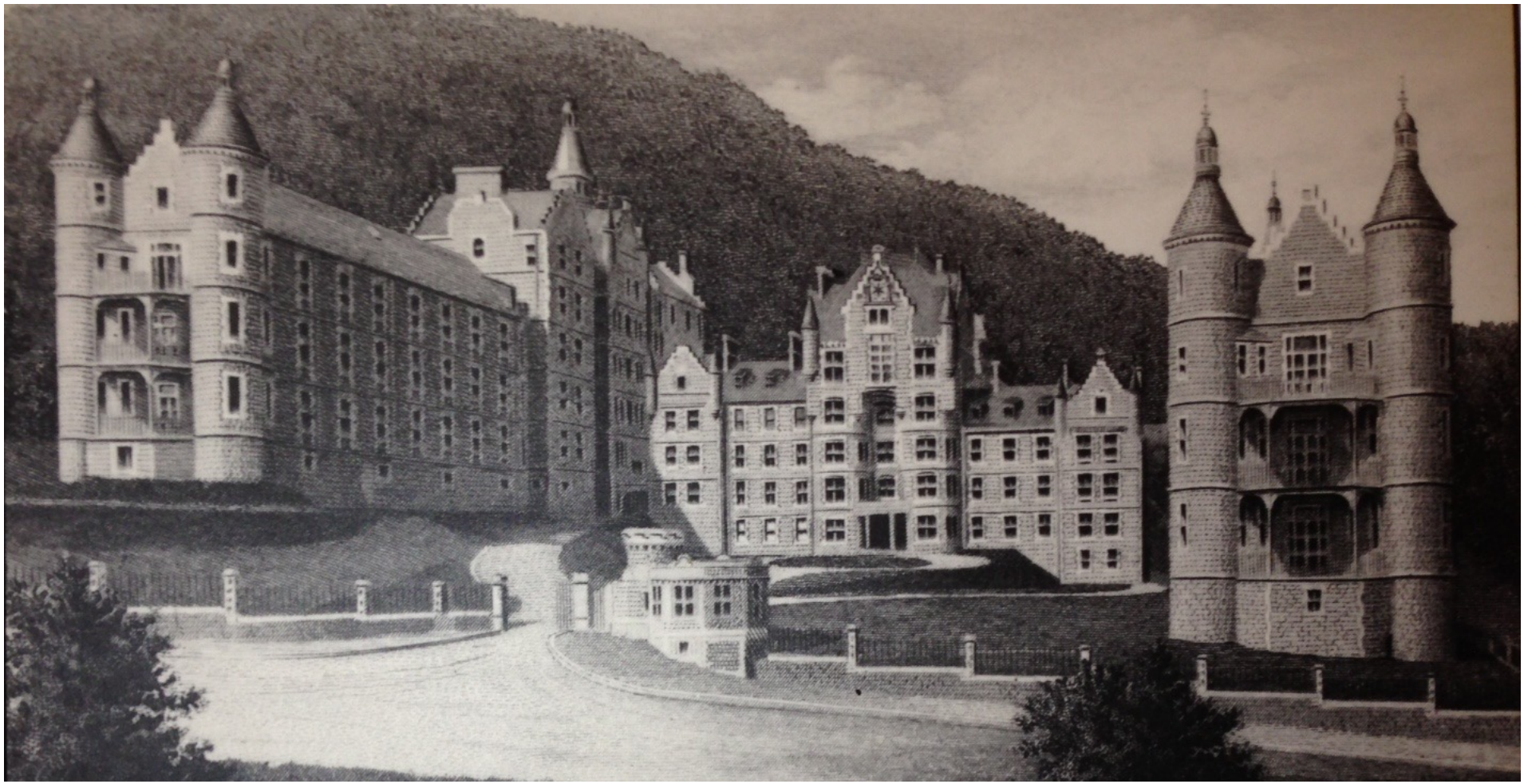
- The biology of Montréal of 1957 was also incredibly different from today. It really was two cities. To the east of St Laurent they spoke French. To the west, English. People seldom crossed this line.

- McGill and the RVH were definitely in the West.

  100% English language and close to 100% of British descent.

- As you can still deduce use from some of our present Street names most of them were Scots.

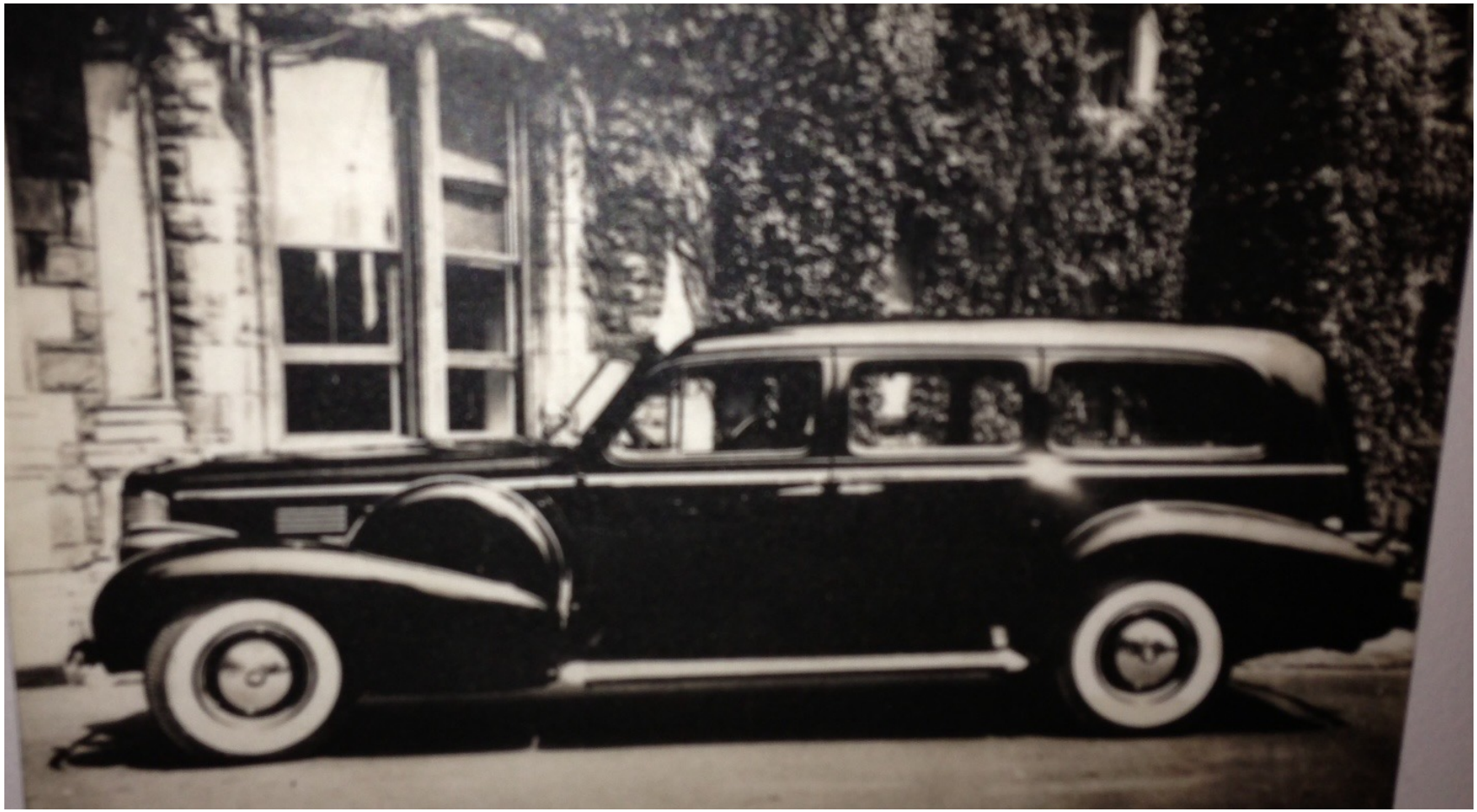
The RVH looked very much like this 1896 drawing. On its flagstaff flew the Union Jack !! A few months after I arrived I asked the Executive director why.
The next day it disappeared.



The only difference from this contemporary photo is that there was no medical block.

The front entrance looked like this, not very different from today.

Board members had special parking

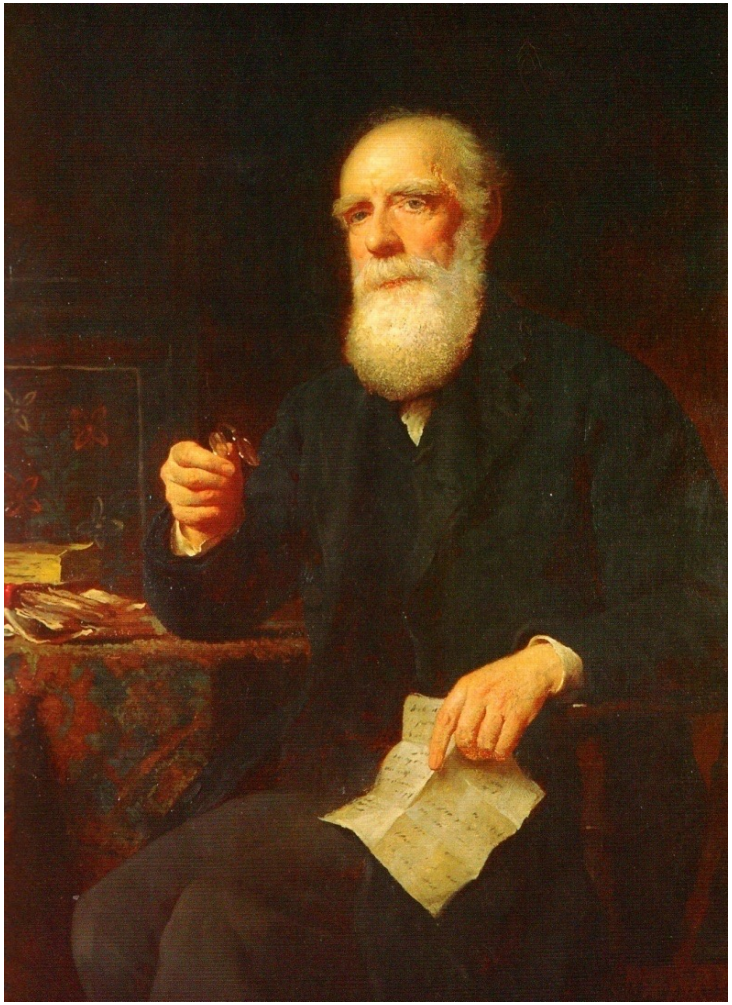


A substantial difference between then and now was the role and personality of the Director General,
Dr J Gilbert Turner . Ex Wing Commander.

Dr Turner's office was not in some distant office block. It was just inside the front door. He knew us all.
He knew when we got to work .
At least twice a week he would stand in the front entrance and greet us as we arrived, doctors, secretaries, orderlies. A man to respect.

After you got past him you were met by the two Scottish immigrants who made money out of the railways.

George Stephen, and his cousin, **Donald Smith**



Their intentions for the hospital are set out on the foundation stone. You can read them on your way home.
" For the relief of the suffering poor " This was not to be another private hospital for the well-heeled, though there was to be one Pavilion, the Ross, for private patients.

and for the advancement of the arts of healing". Research. It is extraordinary that the founders were so committed to research so long ago. It was unheard of.

And it was not just propaganda. They really were serious about research. Take for example an early Physician in Chief,

Jonathan C Meakins, Physician in Chief, of the RVH. 1924

A Scot. University of Edinburgh. First full-time Chair. Strong research interest. Especially respiration.

1925 textbook.

In 1930, Ronald Christie another Scot, was attracted to Montréal to do a research fellowship with Meakins.

Christie returned to London in 1937 and became Head of Medicine at St Bartholomew's Hospital.

But after Meakins, research dropped off for a few years. To reignite it the Dean recruited another Edinburgh Scott

Ronald Christie

Christie, another Edinburgh Scott, post-doc Fellow, RVH with Meakins (1930).

Respiratory mechanics. Pneumothorax (Bethune).

The law of minimum work.

1955-64. Physician in Chief, RVH

He brought with him one recruit, Dr David Bates.

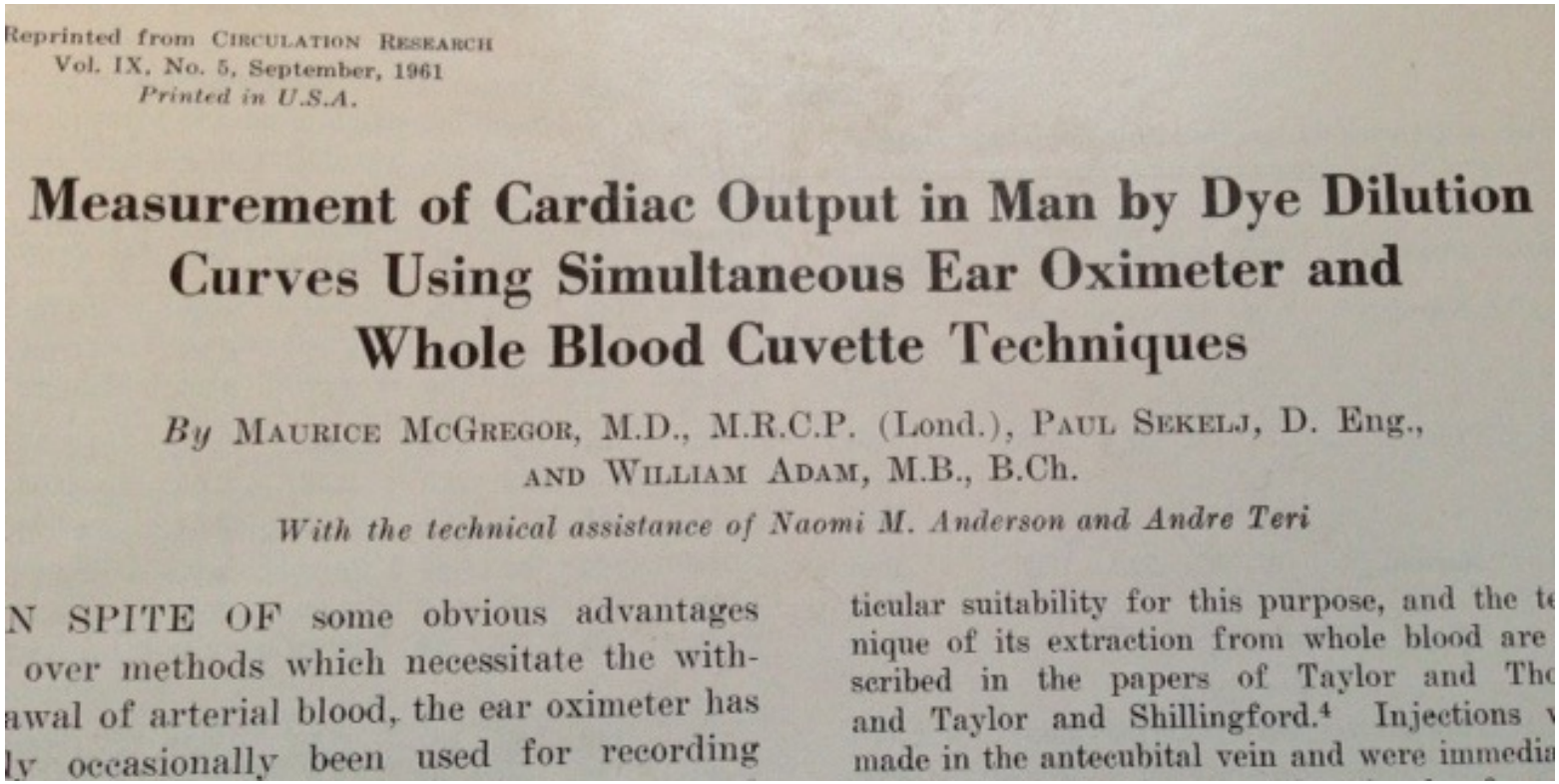
(The arrival of Bates and Christie is the reason I chose Montréal and the RVH for our future home.)

David V Bates

To get research going again, in 1958 Christie established the **Joint Cardio-Respiratory Unit** of the Royal Victoria Hospital and the Montréal Children's Hospital, with Bates as head of the much larger respiratory half.

This arrangement was extremely productive.

For my first year at McGill I was mostly at the Children's Hospital. Paediatric cardiology was not yet a specialty so no one thought twice about my being at both hospitals. First of all we needed a non-traumatic way to measure cardiac output in children. The instrument which we described in this paper was built in the Children's Hospital workshop by Paul Sekelj.



Reprinted from CIRCULATION RESEARCH
Vol. IX, No. 5, September, 1961
Printed in U.S.A.

Measurement of Cardiac Output in Man by Dye Dilution Curves Using Simultaneous Ear Oximeter and Whole Blood Cuvette Techniques

By MAURICE MCGREGOR, M.D., M.R.C.P. (Lond.), PAUL SEKELJ, D. Eng., AND WILLIAM ADAM, M.B., B.Ch.

With the technical assistance of Naomi M. Anderson and Andre Teri

N SPITE OF some obvious advantages over methods which necessitate the withawal of arterial blood, the ear oximeter has ly occasionally been used for recording

ticular suitability for this purpose, and the te nique of its extraction from whole blood are scribed in the papers of Taylor and The and Taylor and Shillingford.[4] Injections made in the antecubital vein and were immedia

At the Vic with David Stubbington and later Wilf Palmer, we I started up heart catheterisation in a room which is presently close to Larry Stein's office.
No catheters were being made. We our own from polyethylene. But strain gauges to measure pressure were available.

There was still no image intensification so we had to use lead aprons, and wear dark glasses for 10 minutes before we started so as to be able to see in the dark .

In 1961 the new Medical block was finished and we moved into our first designated heart catheterisation lab and within a year or so we received our first image intensifier.

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Each case was an “experiment”. We did a maximum of two patients per day! On Saturdays when no one was looking we used the Cath lab for dog studies.

We were unencumbered by ethics committees and the only grant application we had to write was a letter of thanks to a wealthy donor with a report of what we had been doing

It was expected in those days that at any decent training centre Residents would spend some time in research.

For the next 10 years or so I think every Resident and Fellow presented at a meeting in the US and authored a paper.

In the following list of publications by residents you may recognise some names.

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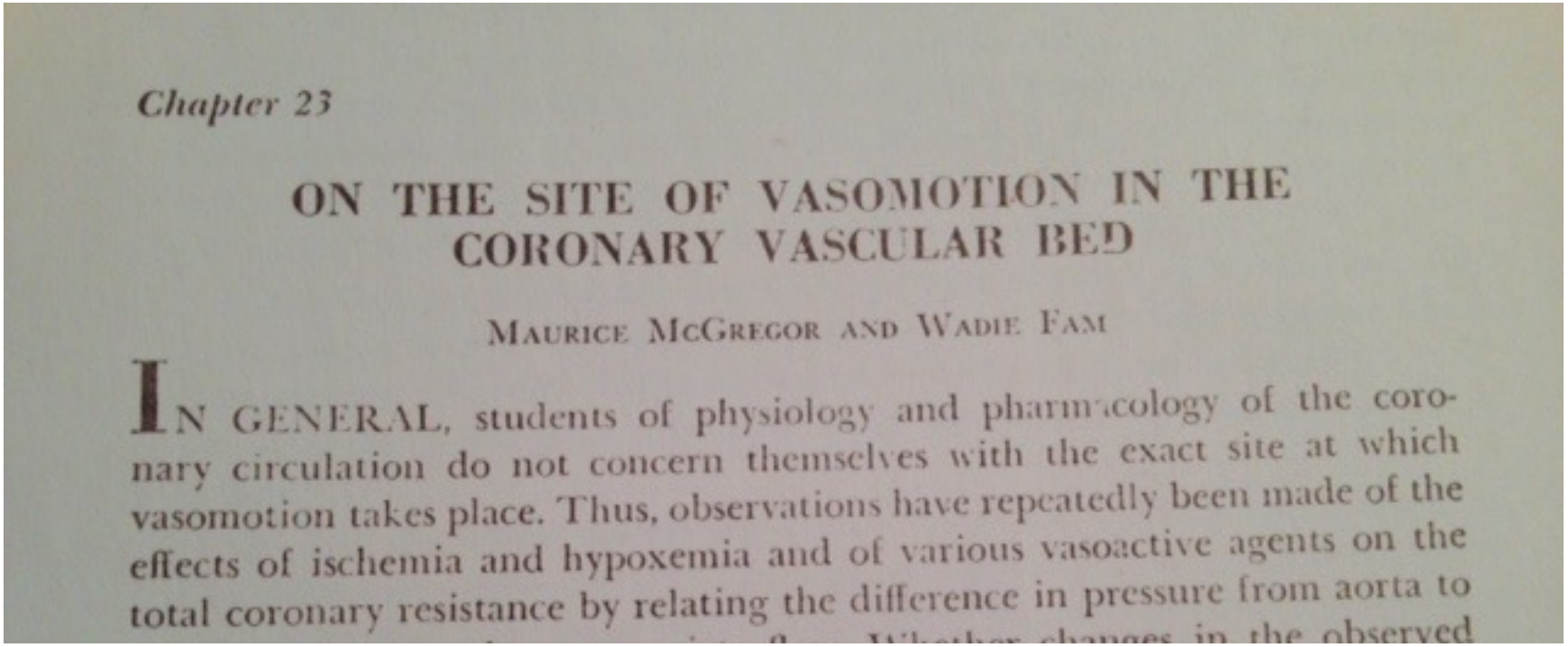
Probably the most significant studies we carried out at this time were with a fellow from Egypt, Wadi Fam, on the physiology and pharmacology of the coronary bed. The thinking was that the only intervention that relieved angina was a “coronary dilator drug”, nitroglycerin. So all efforts were directed to finding ***more potent dilators***. When one was found, Persantin (dipyridamole) did not relieve angina and sometimes made it worse.



Chapter 23

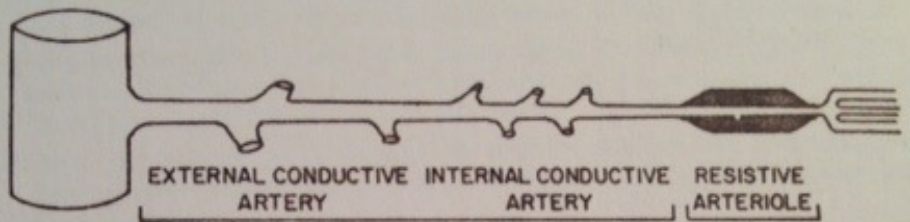
ON THE SITE OF VASOMOTION IN THE CORONARY VASCULAR BED

MAURICE MCGREGOR AND WADIE FAM

IN GENERAL, students of physiology and pharmacology of the coronary circulation do not concern themselves with the exact site at which vasomotion takes place. Thus, observations have repeatedly been made of the effects of ischemia and hypoxemia and of various vasoactive agents on the total coronary resistance by relating the difference in pressure from aorta to

We showed that functionally the coronary artery could be divided into two portions, conductive vessels and the terminal resistive arterioles, and that these reacted quite differently to different stimuli. I won't discuss this further because today it is all part of accepted knowledge.

muscle become interconnected by collateral channels, this mechanism may



STIMULUS	REF.	↑	↑
MYOCARDIAL ISCHEMIA	(1)	NIL	DILATE
DIPYRIDAMOLE	(2)	NIL	DILATE
NITRITES	(2)	DILATE	NIL
ISOPROTERENOL	(9) (10)	DILATE	DILATE
EPINEPHRINE	(9) (10)	DILATE	DILATE
N-EPINEPHRINE	(4) (10)	DILATE	DILATE
PROPRANALOL	(14) (10)	?	CONSTRICT
ANGIOTENSIN	(9) (10)	? CONSTRICT	CONSTRICT
PITRESSIN	(15) (10)	CONSTRICT	CONSTRICT
PHENYLEPHRINE	(10)	CONSTRICT	NIL

Figure 23–7. Probable site of vasomotor changes in the coronary arterial bed as a consequence of ischemia and certain drugs. Note: (a) Intravenous or intracoronary nitroglycerin in high concentration has a transient vasodilator effect at the resistive arteriole (13). Likewise, when injected directly into the muscle, it will cause a more sustained increase in flow (10). (b) There is conflicting evidence concerning epinephrine and norepinephrine and it seems effects may vary with dose.

Cardiovasc. Res., 1969, 3, 472–475.

Intramural Pressure in the Left Ventricle of the Dog*

GIORGIO BRANDI† and MAURICE MCGREGOR

From the McGill University Clinic of the Royal Victoria Hospital, Montreal, Canada

AUTHORS' SYNOPSIS. *The pressure within a fluid pocket in the ventricular wall increases with the size of the pocket introduced. By observing the pressure in pockets of varying size, it is possible, by extrapolation, to estimate what the pressure would be in the absence of a pocket. This pressure varies from cavity pressure close to endocardium to ambient pressure close to the epicardium.*

Previous reports indicate that the "tissue pressure" in the deep layers of the left ventricular muscle is very variable and may exceed the simultaneous pressure in the cavity (Johnson and Di Palma 1939; Gregg and Eckstein, 1941; Laszt and Müller, 1958; Kreuzer and Schoeppe, 1963; Kirk and Honig, 1964).

Since the heart muscle is a structure in which the source of mechanical energy—that is, the contractile element—is directionally orientated, it is necessary to examine forces in a vectorial fashion. This is, of course, not possible by simply measuring the pressure in a fluid pocket. It can be assumed however that a volume of fluid will accommodate itself in such a manner that force acting over its surface is minimal. The introduction of even the smallest volume must cause distortion of the tissue architecture and this will be greater in proportion to the volume of liquid introduced. Thus pressures measured after introduction of fluid must be greater than the pressure existing before the fluid pocket was created by a value which increases with the volume of the pocket.

We have developed a technique by which a fluid pocket is continuously fed by a very small saline flow. Pressure measurements are repeated at different flow rates. Then, by extrapolation, the intramural pressure can be estimated at zero flow when there is presumably negligible tissue distortion.

Accepted May 2, 1969.

* This work was supported by grants from the John A. Hartford Foundation Inc. of the U.S.A. and the Medical Research Council of Canda, grant No. MT-1241.

† Present address: Instituto di Fisiologia dell Universita, Modena, Italy.

Methods

The experiments were carried out on six large (20–[illegible] kg) mongrel dogs. They were anaesthetized and [illegible] ficially ventilated. An initial dose of 30–40 mg/kg sodium pentobarbital was given and successive doses of 5–10 mg/kg added when required. The chest was opened in the fifth left intercostal space and the pericardium was excised and sewn to the chest wall in order to expose the left ventricle in a pericardial sling.

Two syringes (20 ml.) were tightly fitted to a multiple-rate infusion apparatus (Harvard, 2056), a pressure

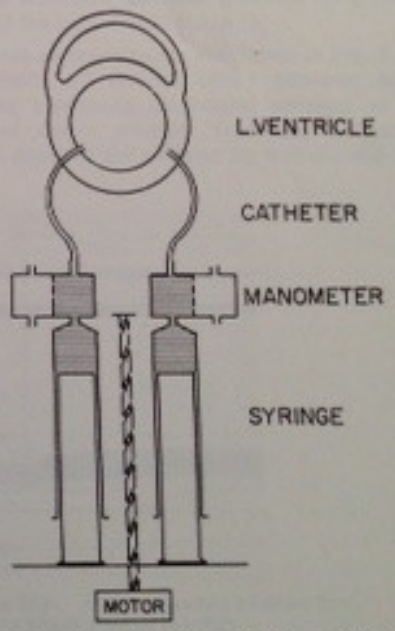


Fig. 1. Schematic description of the experimental pr[illegible] paration.

And then, of course, coronary flow was also affected by the direct forces exerted on the vessels by the contracting myocardial muscle. These were studied by Giorgio Brandi a research fellow from Italy.

After 10 years this very pleasant life was interrupted for me when they asked me to be Dean. (One of the differences between then and now is that in those days you didn't apply for jobs like that. You were invited. In fact, apart from applying to come to McGill I have never applied for any job).

It turned out not to be a dull job. An extreme nationalist group, the FLQ, started planting bombs around the town and several times we had to evacuate the McIntyre.

Then in 1970 all the doctors of Quebec went on strike in protest against the introduction of Medicare. Most of our faculty left the province and the hospitals were run by a few volunteers and the Residents and students.

It was all very tense and would not have ever ended without the help of the FLQ.

In October they kidnapped the British Trade Commissioner in his house next to the medical school, and as a follow-up they captured and then murdered a prominent cabinet minister. A state of emergency was declared, the army patrolled our streets and everyone, was ordered back to work. This successfully ended the strike.

- And there were other events to contend with. Not the least wasthe international students “revolution” which rocked universities from Berlin to UCLA. At Concordia (at that time Sir George Williams U) students occupied and burned down the computer building. At McGill the principal’s office was “occupied” for several weeks,and in the medical school all important documents were put in the safe each night. But our students were a lot more creative, opening an STD clinic in the inner city and drop-in medical clinic at Point St Charles.

Another problem was the McGill Francais movement, which aimed to make McGill a French only institution. On one exciting night, they staged “Operation McGill”, a parade of 15,000 along Sherbrooke St, meeting at the Roddick gates.

I think you have had enough about change for now Some has been good and some less good. I leave you to judge. For me personally, the disappearance of the two cities divided by “the Main”, the transformation of McGill into a comfortably bilingual organism and its acceptance as an integral part of Quebec, are profound improvements for which to give thanks.

So I will leave you Now, to contemplate the extraordinarily beautiful, and mostly tranquil place we are privileged to work in today.

I thank you for your kind attention and wish you a great holiday season.

The country that adopted us has about 35 million citizens. Most live within 100 miles of the US border.

The blue province, Quebec, is largely French speaking. Canada is a very loose federation and its Provinces are more autonomous than your States.

- When we arrived in 1957 Canadian and American healthcare were still private.
- People paid for doctors and hospitals when they needed them, out of their pockets or through insurance.
- But many could not afford to do either. I learned that I was expected to overcharge the 'wealthy' and treat the poor "for free".
- But in ***1972*** all that changed, and we joined the industrialized nations that had already adopted ***universal prepaid health care***.

Introduction of universal health-care.

- Germany (Bismark)……1883-89 [Compulsory ins]
- New Zealand…….. 1941
- France ……..…….. 1945
- UK (WW2)……1948 [Central/govt]
- Sweden……1955
- Japan ……1961
- **Canada**…(Sask-Quebec)……1947-72 [UK Model]
- Australia……1974
- Italy ……1978
- Spain ……1986
- Switzerland ……1996
- **USA …….?…..**2013

Introduction of Canadian health care

In Canada health is a provincial responsibility .

1947: Sask. Public hospital insurance.

1957: Canada. *Hospital insurance act.*

1961: Universal free hospitalisation.

[Doctors still billed their patients.]

1966*: Medical Care Insurance Act*. Federal Government offers provinces to refund half the cost of health services, on condition provinces pay the rest and there was ***universal access,*** and ***portability .***

A stormy beginning

This was an offer that was hard to refuse.

But in Quebec it was bitterly opposed by the doctors who organized a comprehensive strike.

- At that time I was Dean of Medicine at McGill and I watched in dismay as a large number of my faculty quit their jobs and left the province.
- This went on for some weeks but was eventually overtaken and ended by an even more stormy event, subsequently called the “October Crisis”.
- There was, and still is, a strong separatist movement in Quebec that aims to make the province an independent country.

In October 1970 a small extremist group kidnapped the British Trade Commissioner in his house next to the medical school, and then a prominent cabinet minister who they murdered. A state of emergency was declared, the army patrolled our streets and everyone, was ordered back to work.

What is included in Canadian Medicare

Fortunately, when the state of emergency ended the Quebec doctors had no appetite for a renewal of their strike and Medicare legislation was introduced and became effective in 1972.

There have been some changes, but more or less, the costs of ***doctors*** and ***hospitals*** are paid by the state from taxation. So there are no health related bills for these services in Canada. Which saves us a lot of money.

What is not covered? Dentistry and in most provinces , out of hospital medication.

The Problem. Increasing Cost

Once this system was installed and functioning it became extremely popular.

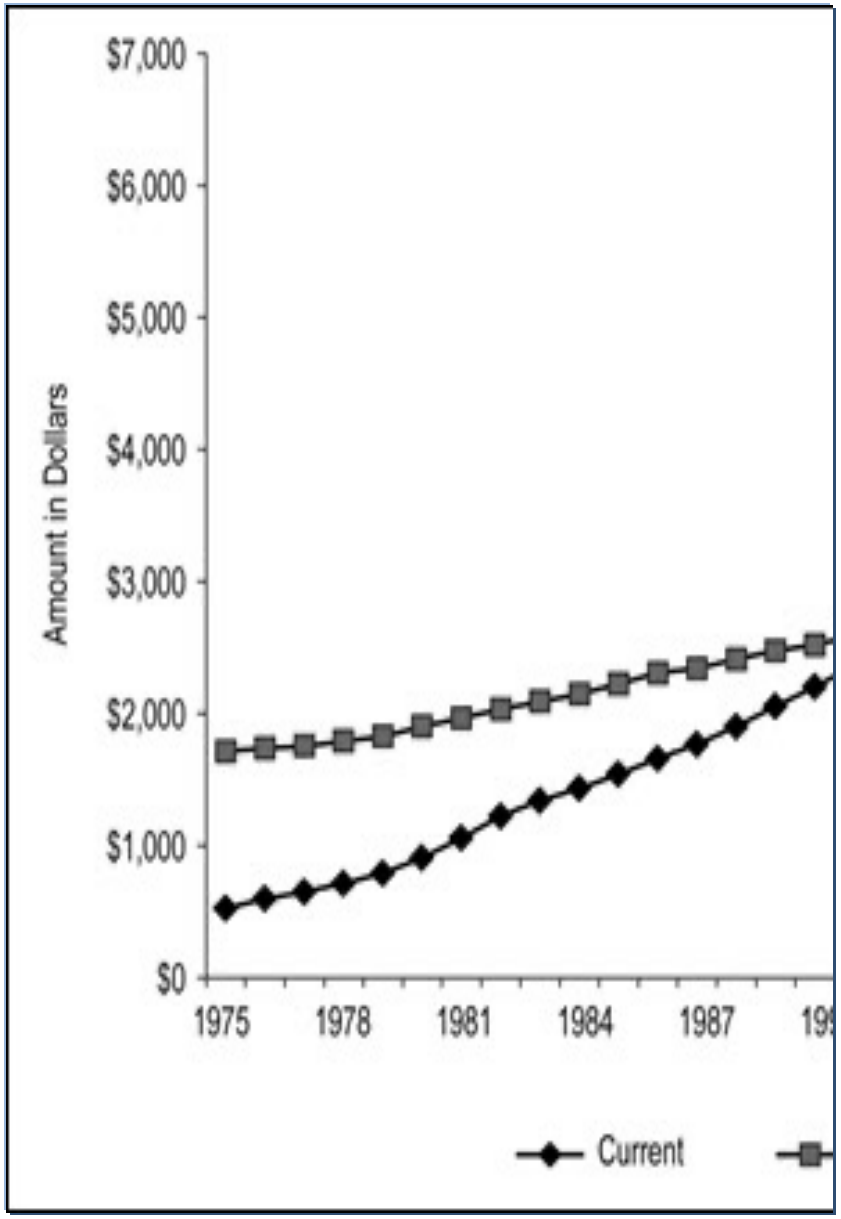
We upgraded our hospitals, which had been largely charity institutions.

And all healthcare workers, doctors included, negotiated better incomes.

And of course citizens enjoyed not having to worry about the costs of illness.

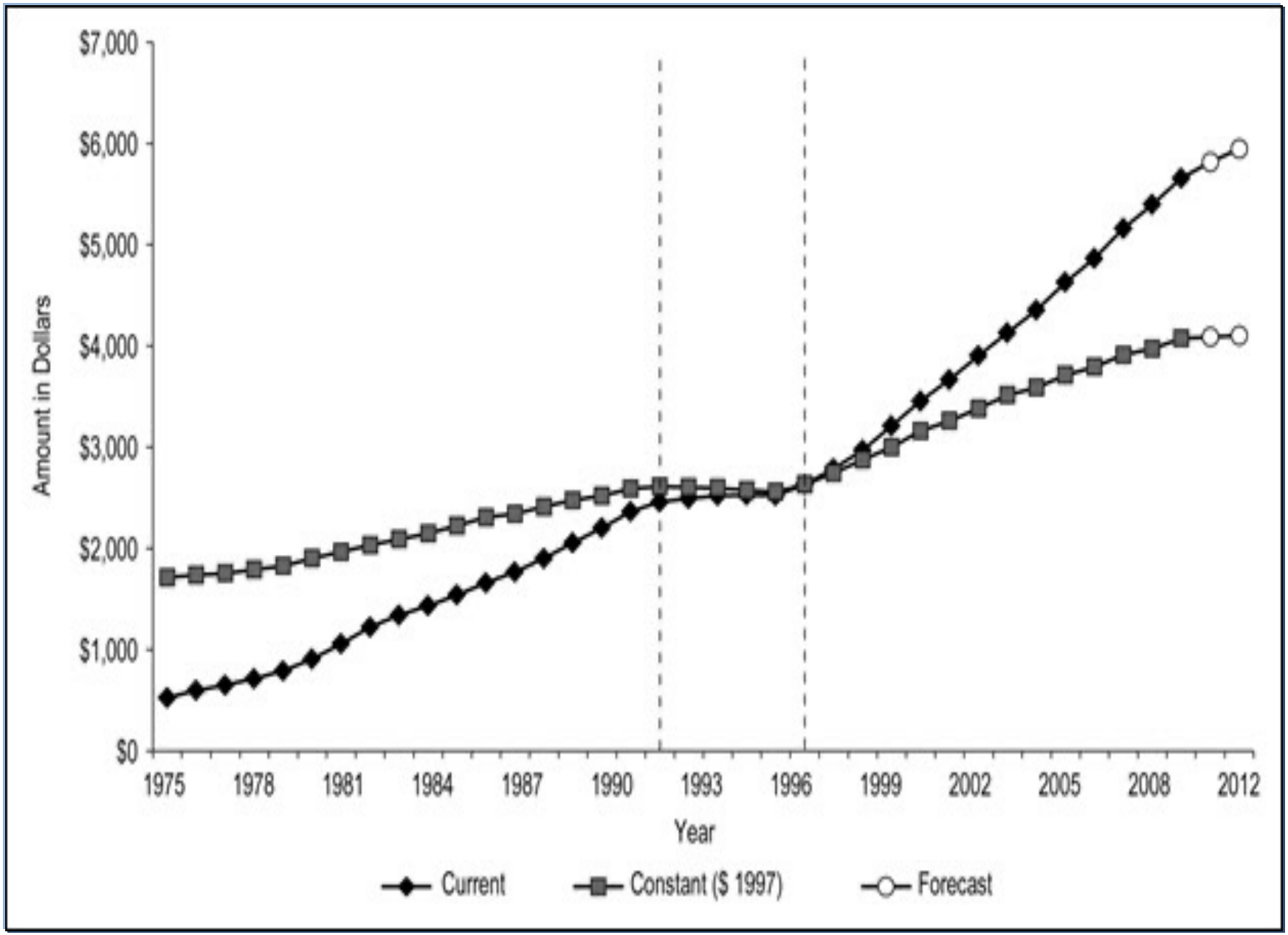
So, as expected, this was accompanied by a substantial increase in costs.

Total Health Expenditure per Capita, Canada, 1975 to 2012. CIHI

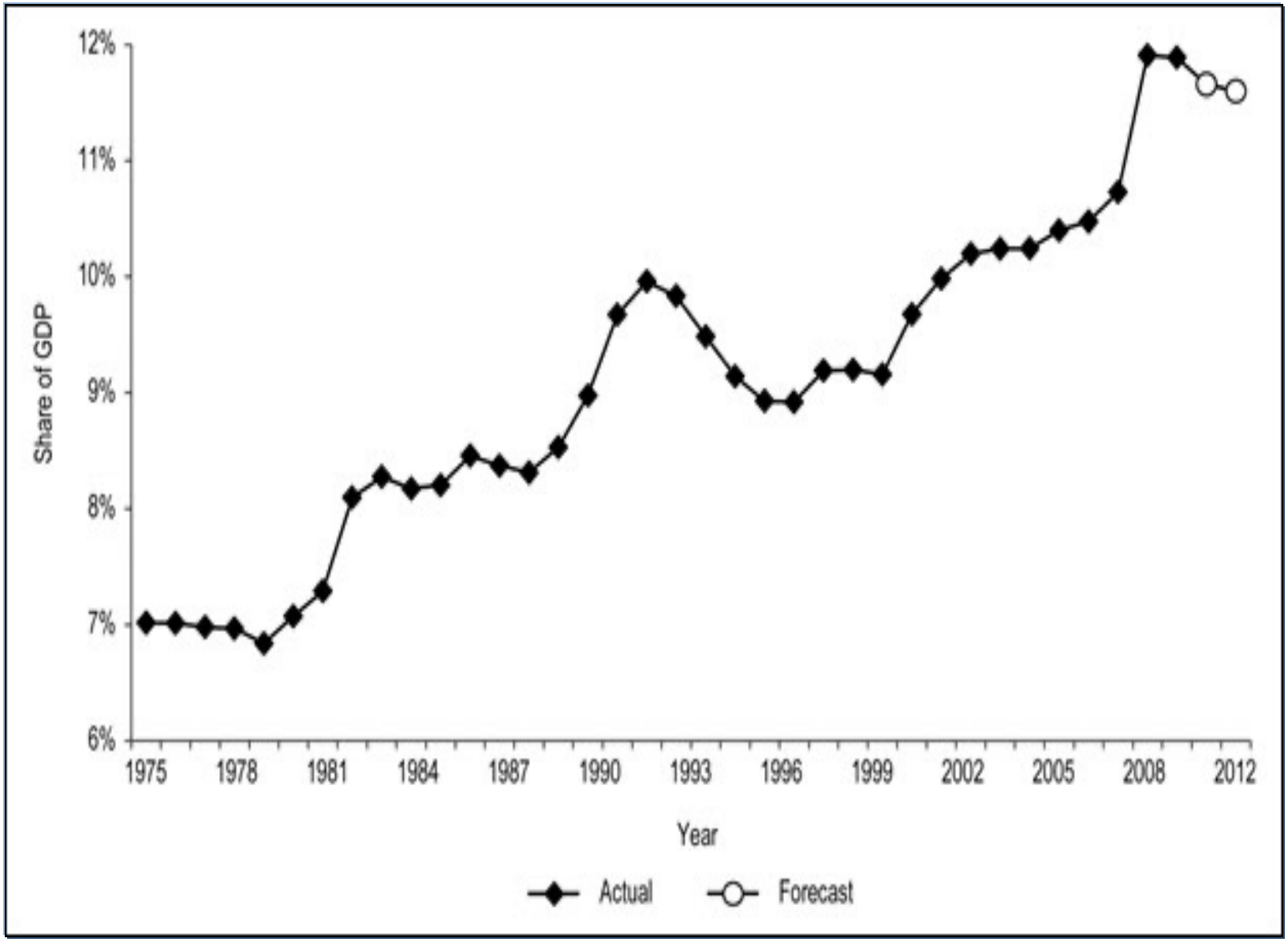


This slide shows total health expenditure per capita(the squares show constant dollars) from 1975 to 1990. The problem was that after the expected high cost of getting the new system going, the cost still kept rising. By 1990 this was causing a lot of anxiety. The next slide shows what happened next.

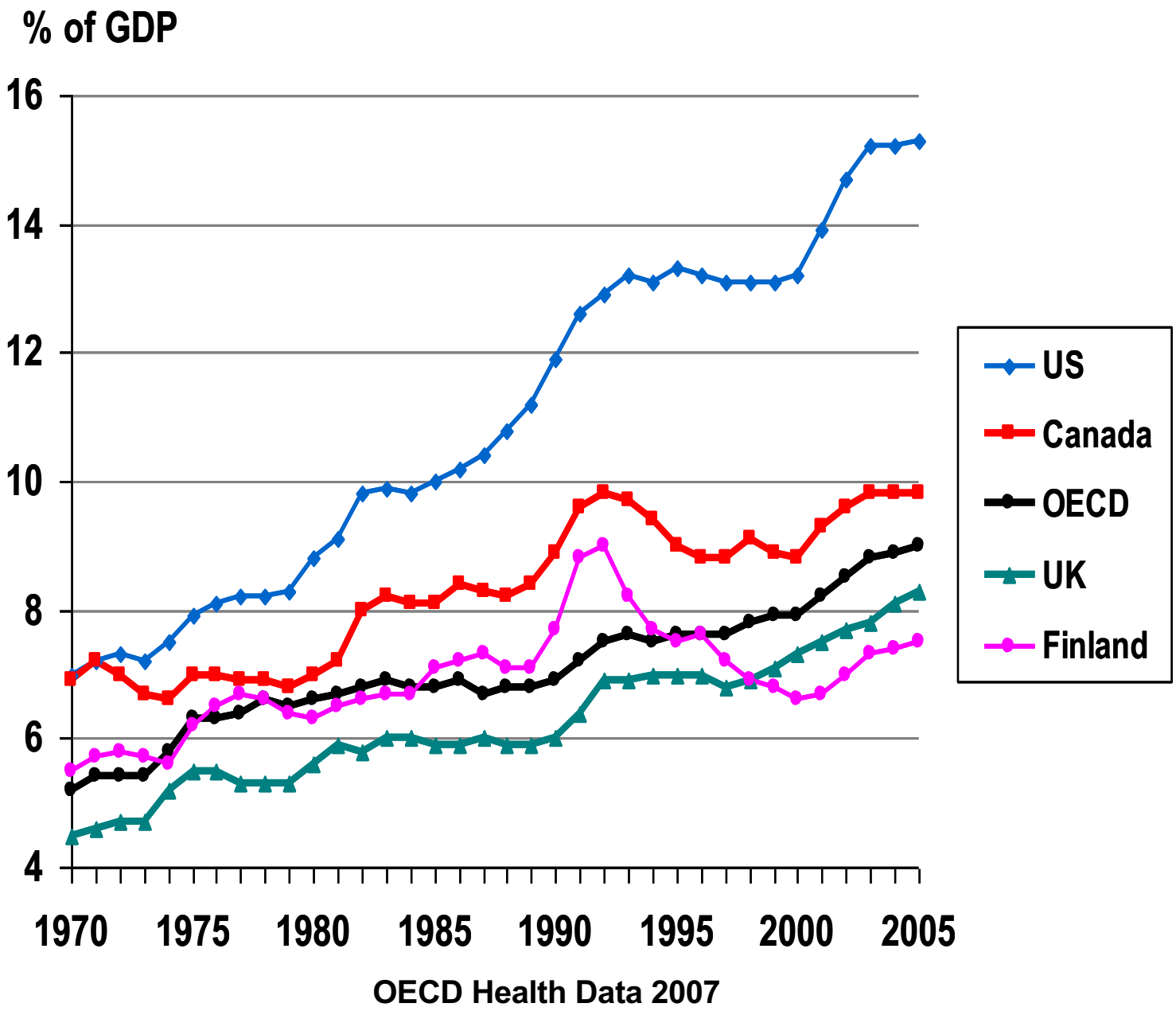
Total Health Expenditure per Capita, Canada, 1975 to 2012. CIHI



Total Health Expenditure as a Percentage of Gross Domestic Product, Canada, 1975 to 2012 CIHI



- This is obviously unsustainable. We cannot go on spending more and more of our resources on health care or there won't be anything left to pay for schools or roads or defence.
- What's more this is not just a Canadian problem. It seems to be a universal problem.
- And the cost is rising even faster in the US than in countries that have Medicare.


% of GDP
16
14
12
10
8
6
4
1970
1975
1980
1985
1990
1995
2000
2005
US
Canada
OECD
UK
Finland
OECD Health Data 2007

So the next question is this,why do health costs keep rising?

Is it the doctor's fees? Is it the increasing incomes of health professionals, or health administrators? Or ageing of the population? The answer seems to be no, or only a little, to each of these.

It seems that the biggest single driver of increasing health costs is the ***introduction of new and expensive technologies***.

Definitions

- Health Technology
  - The “ techniques, drugs, equipment, and procedures used by healthcare professionals in delivering medical care to individuals, and the systems within which such care is delivered.”

(OTA, U.S. Congress. Banta & Behney 1981)

The *biggest driver of increasing cost* is the cost of new technologies.**[Fuchs 1996]** . "The increased capabilities of medicine" **[Newhouse 1992].**

All the new tests, procedures, devices, and drugs that we adopt each year. [Eg cardiology]

- **Estimates of the proportion of the increase in health spending attributable to expansion of technology-**

  US, 1998……....39% [Mohr 2001]

  Us 1983-93……...About 75% [Peden 1998]

  UK, 1977- 2000……..50% [Wanless 2001]

  US & Canada,1975-2000…....66% [Di Matteo 2005]

  .

And the question is not, why do we keep inventing new technologies, but what is to stop us?

Because once we have paid taxes (in Canada) , or our health insurance premium (in the USA), we feel that for us any health services we need are for free. Because the costs are paid for by others. There is no economic restraint.

And there is virtually no limit to the number of new technologies we can invent and sell to a limitless market in which the consumer (and her doctor) don’t have to pay.

- If we made food or electricity free we might waste a lot but there is a limit to the amount we could waste.
- But when we make the products of ***inventions***, of tests, bone scans, MRIs, headache pills and heart transplants “free” to the consumer, there is virtually no limit to the variety of health services we can invent. We can even invent diseases for them to cure.
- ***There are just no brakes on the system***

And the problem is that:

- These technologies are mostly effective.

  We really need them.
- But very few of them save any money.
- New hips and pacemakers and cancer drugs and genetic tests improve both the quality of life and the length of life.

  And ***they all cost money***.
- And the longer people live, the more technologies they use.

But eventually the cost rises ***more than we want to pay.*** Then something has to give.

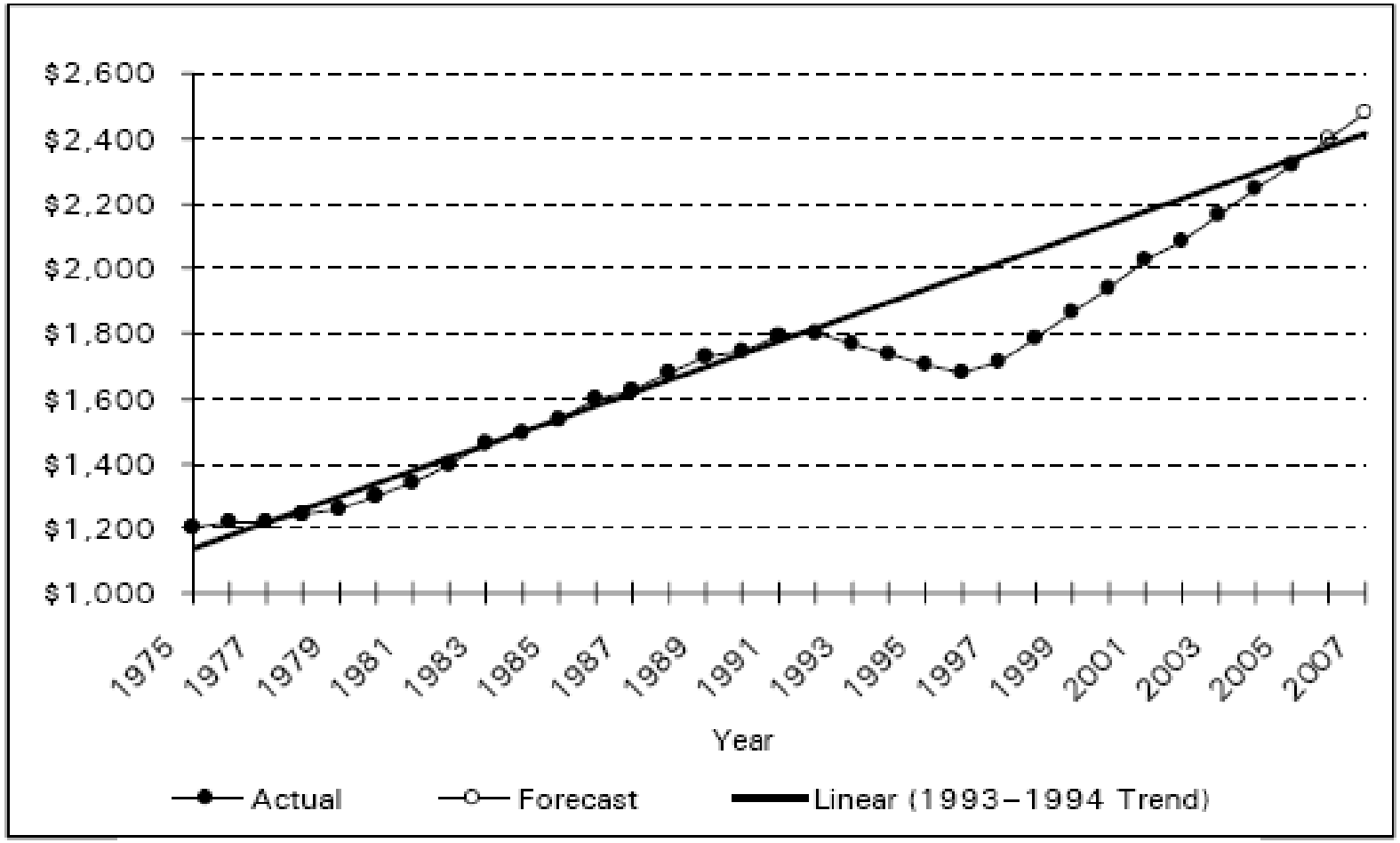
No politician who wants to be elected dare mention it. But what we do is to start rationing.

In the US, you ration by raising the cost of health insurance. I understand that before your new legislation about 40 million citizens could not afford it.

In Canada, we ration by holding back the money (chiefly from hospital budgets) so that the system cannot grow in response to demand.

And an increasing demand without a corresponding increase in capacity means queues. ***Wait times***.

Figure 26. Provincial/Territorial Government Health Expenditure per Capita in Constant 1997 Dollars, Canada, 1975 to 2007



Sources: National Health Expenditure Database, CIHI; Population, Statistics Canada.

Up to now I have tried to make three points:

1) That increasing cost in every developed country is making health care ***unsustainable***.
2) That the biggest cause of increased health cost is the growth and acquisition of new ***technology.***
3) Our failure to pay for increasing demand results in rationing. In Canada through ***wait times***. And in the USA through ***increasing premiums.***

So what can we do about it?

No 1. Economise.Cut back spending.

Obviously, if healthcare is costing too much we must economise.(salaries, research, administration, etc).

And wherever this can be done without harming the system, this is what we should do.

But there ***is a catch*** to all these measures.

It was been pointed out by Schwartz (1987) that if the annual cost increase is caused by expanding technology, ***making economies elsewhere*** can only have a ***temporary effect.***

This was pointed out again by Eddy in1994 who did some back of the envelope sums.

More efficiency, less waste, can only buy time.

If, from 1970 on, the USA had reduced costs:

On medical supplies, drugs, administration by.50%

On physicians income by…….. 20%

On public health programs, research, construction by……..100%

Costs would stop rising for only 1.9 years

Thereafter, the rate of increase would be the same.

Because, to control cost increase we must ***control what is causing the increase. Technology***

(D.Eddy.JAMA1994;272:324)

Reducing expenditure on health technology.

So this tells us that if we want to permanently reduce the rate of increase of health costs, we have to ***tackle the cause,*** the increasing expenditure on technology.

This is no easy trick. It is the very success of medical research and its application that has given us the unbelievable advances in health care of the last 50 years.

So the next question is, ***How can we control this growth without losing the benefits it brings?***

If I knew a single, doable answer to this question I would run for president.

But there are some questions we should ask.

1. Are the technologies that we use ***effective***? Do they do what they claim to do? Is there evidence?
2. Are they ***efficient***? Do they do what they claim to do at the lowest price? Or are we being gouged?
3. Are they being used ***appropriately***? For the proper indications? ***Overused***?

The first two questions are now being asked worldwide using a relatively new discipline called Health Technology Assessment or HTA.

Since HTA has been my full-time occupation for the last 25 years allow me tell you a little bit about it.

Health Technology Assessment (HTA)

Definition. HTA is the objective, scientific analysis of the health benefits, risks, costs, and ethical, and legal issues of a health technology.

To ***inform policy decisions***.

In the USA was HTA was developed at by the Office of Technology Assessmen, the OTA, set up by Congress in the early 1970s.

Congress wanted a source of scientific information about the effects and the costs of the issues they were considering , that was ***independent*** of the Administration.

They soon needed a division for health issues, the **Office of *Health* Technology Assessment (OHTA).**

For some reason after a few years it was abolished. But fortunately it had been noticed and admired in Quebec where our legislators created a Quebec version of your OHTA.

- So, it came about that in 1990 I was given the job of setting up the Quebec Council for Technology Assessment.
- Our job was to develop advice for government on the acquisition and use of health technologies based on scientific evaluation of the evidence.
- The use of HTA has since spread widely in Canada and around the world.
- The models that have been developed vary greatly. But in general they are successfully answering the first two questions : *Are these technologies* **effective** *and* ***efficient*** *?*

- And through the systematic asking of these two questions at the time of acquisition of new technologies our healthcare systems are making significant economies.
- But ***not enough*** to arrest the ever-increasing costs of our healthcare systems.
- To do this we must address the third question:

We must make sure that the technologies already in use are being used ***appropriately,*** and not being ***overused***? Because overuse is a major source of waste.

- How do we know this? Let me give you some examples.

Between 1994-98 there was an increase in the number of veterans (from 2.6 to 3.1 million).

At this time the US Department of VA undertook a major Healthcare reform [Kizer1999].

In spite of increase in the number of veterans, the number of hospital beds in use fell by 55%.

Were the veterans being cared for elsewhere? No, there was no compensatory increase in private hospital use.

Did the veterans suffer as a result of reduced hospital use? The indices we have suggest that they did not. One year survival rates were unchanged or significantly improved [Ashton 2003].

- Was this a unique case? Just the Dept of VA? Much evidence, mostly from the Dartmouth group, suggests it is not.
- They have shown, for example, that different regions of the US use incredibly different quantities of healthcare.
- In the year 2000, for example, after adjustment for age, sex, and race, the per capita Medicare spending in Manhattan, NY, was $10,550 but only $4,823 in Portland, Oregon.
- Medicare enrollees in Manhattan spent more than twice as much time in hospital and had twice as many visits to physicians.[Dartmouth 2003]

- **Are they under treated in Oregon or over treated in Manhattan**?
- There is much research that shows that high-intensity practice is associated with lower quality of care and worse outcomes.[Fisher,Wennberg 2003]
- For example, patients with hip fractures, colorectal cancer or heart attack who received conservative practice patterns have been found to have better survival.
- It has been estimated that if all regions could practice like the conservative regions, Medicare spending would fall 30% [Skinner 1997]

- You have been most patient.
- Before I conclude I must confess to bias.
- I have worked in private systems in which ***what my patients received*** was determined by ***what they could afford***.
- And I have worked in public systems in which ***what my patients received*** was determined ***only by their health needs***.
- **I *profoundly* prefer the latter .**

- But my preferred health systems are threatened. Their rising costs are making them unsustainable.
- The principal cause is the success of the technological revolution which flourishes ,unrestrained by need for payment by the user.
- We are starting to successfully control the acquisition ineffective and inefficient new technologies.
- But we have not yet succeeded in eliminating the wasteful use those technologies already installed.
- ***Thank you for listening to my sermon.***

References

Kizer KW. The “new V A”: a national laboratory for health care quality management. Am J Med Qual.1999 14;3-20.are

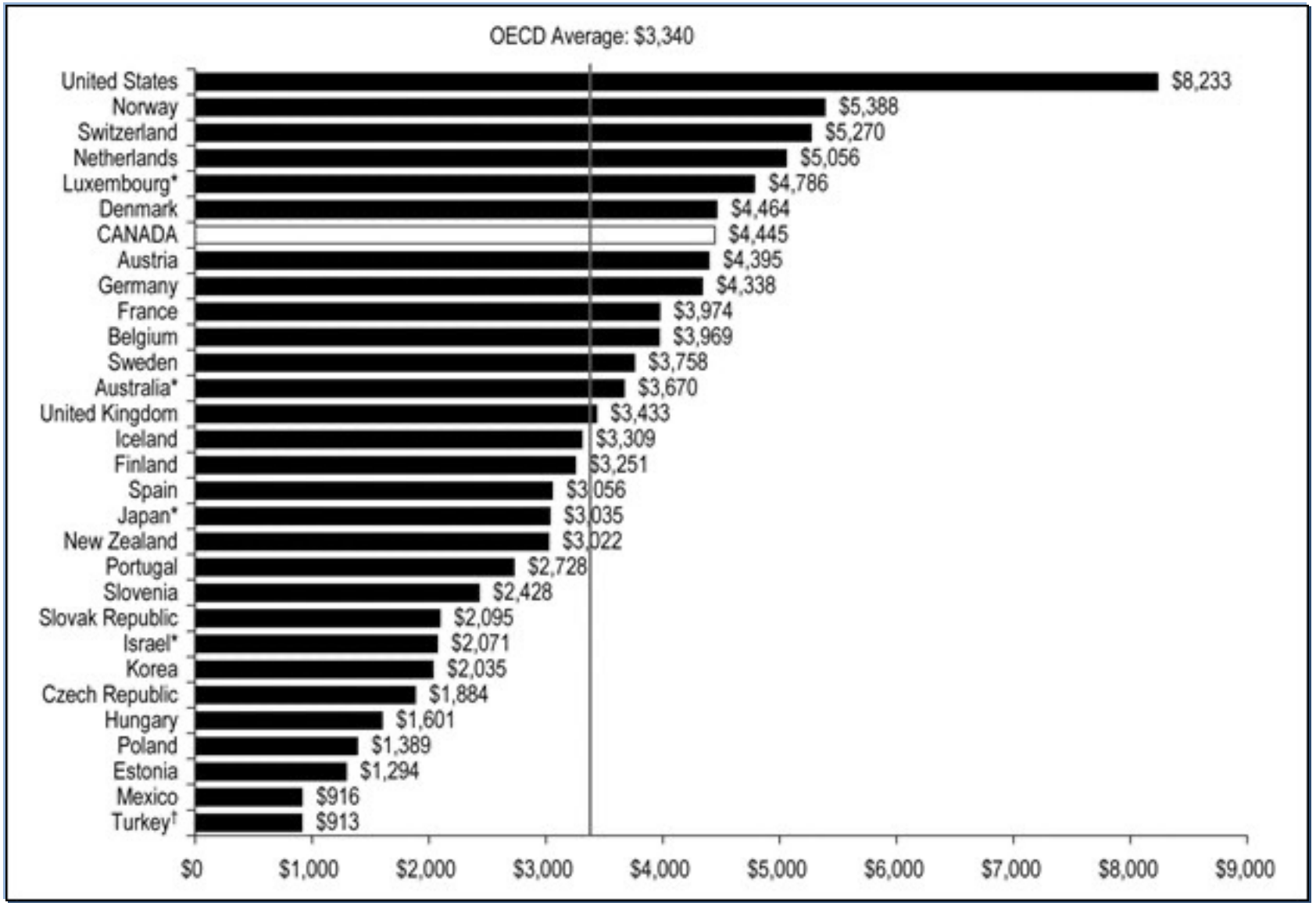
- This body consists of two portions.
- There is a small group of professionals, skilled in searching for evidence, and evaluating and synthezising what they find.
- Their task is scientific and largely objective. They ask the question:

  If we acquire this technology ***how much good*** (lives saved, pain relieved etc), and ***how much harm*** (unwanted side-effects),will it do and ***how much*** will it cost.

- The other portion of the unit is there to recommend the policy that should be followed in the light of the evidence.
- They consider the Opportunity Costs. Given a fixed budget, if we buy this new technology what will we have to do without?
- Their task is subjective, values based. (Is it better to spend available budget on extending the length of life or on the quality of life).
- There are no ***right*** answers to these questions. The most you can hope for is that those who make recommendations are credible and unbiased, and share your ethical values.

- In our hospital these recommendations formulated by a committee consisting of administrators, nurses, doctors, health technologists, and patients, all ***nominated by their colleagues***.

Total Health Expenditure per Capita, U.S. Dollars, 30 Selected Countries, 2010 . CIHI



Question:

Who decides which technologies to acquire?

- Big ticket items (eg a screening programme, or MRI unit) are mostly decided at government level.
- Items of lower unit cost (almost everything else) are decided at the level of the hospital.
- ***At present, each Canadian hospital has to decide for itself which technologies it wants to acquire.***
- Canadian health policy is the sum of these decisions

So how do they make these decisions?

Most hospitals still use « traditional approach »

- **Request made by a specialist user**
- **Supportive data supplied by vendor**
- **Sometimes a special committee**
- **Lobbying. Lobbying. Lobbying.**
- **Decision by administration; in camera**

Circumstances favour acceptance.

- **Professional vs Lay, Institutional pride, Legal liability**.

The MUHC experiment, 2002

Hypothesis: The Hospital could:

1) **Increase the influence of evidence on these decisions**
    - **By in-hospital preparation of evidence**
2) **Better assure incorporation of hospital values**
    - **By democratising the way the hospital made policy decisions**

Intervention: An in-hospital TA Unit

Outcome: Judged by impact on policy

STRUCTURE

To develop evidence-based policy requires 2 steps:

1) **Collection of evidence. Analysis**.

   Science-based, objective

2) **Deciding what to do.**

   Values-based, subjective

This requires two distinct bodies:

1) Professionals . To prepare evidence.

HTAs, literature, local data.

2) Policy committee: Nurses, allied HC workers, patients, administrators, MDs, stakeholders

To recommended policy — what should be done

Process

Topics: problems encountered by administration.

Recommendations: developed by the advisory committee.

Diffusion: reports made public

(www.mcgill.ca/tau/), (10,000 hits / month)

Implementation: by administration

The TAU only gives policy ***advice*.**

But advice based on sound evidence,

with clear explanation of reasoning, made publicly available, is hard to ignore

Example:

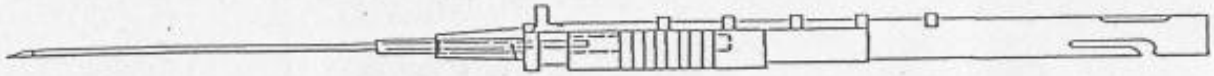
Needlestick safety device

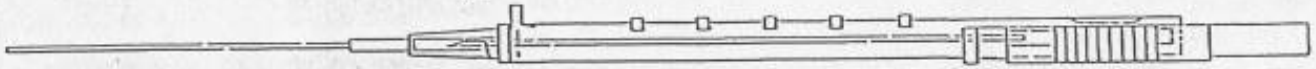
(I use this old example because, for this decision the hospital used two approaches. Traditional/Tau).

The problem:

- Nurses, physicians, and students are frequently injured by needles contaminated with blood
- Safety devices now available reduce this risk
- The issue: Should the hospitals replace presently used IV catheters with a safety device?
    - To prevent injuries when inserting IV lines
    - To prevent infections (HIV, Hep C, and Hep B)

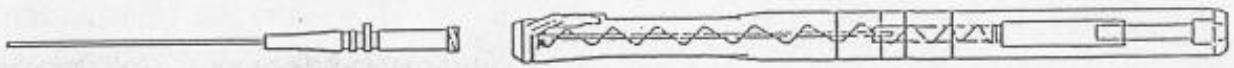
Safety IV Catheter Devices*





protected position

Protectiv™ I.V. Catheter Safety System
Johnson & Johnson Medical, Inc.
Arlington, TX (800) 255-2500
A protective sleeve encases the sharp stylet as it is retracted from the catheter.



protected position

Insyte® AutoGuard™ Shielded I.V. Catheter
Becton Dickinson Vascular Access
Sandy, UT (888) 237-2762
Stylet is instantly encased inside a tamper-resistant safety barrel by pressing the activation button.

Traditional approach

Question reviewed by a special committee comprised of nurses, an infectious disease specialist, and chaired by an administrator

- Assisted by information from suppliers

Traditional Approach

- Considerations
  - 250 needlestick injuries reported / year
  - Net cost is only 57 cents per device
  - These devices now mandatory in U.S., Manitoba, and Saskatchewan; legislation pending in Ontario and Nova Scotia; already used in more than 90 Quebec hospitals
  - At issue is the safety of our staff
- Conclusion
  - A “no brainer” — acquire the device

TAU Approach

The director of nursing also referred the question to the newly developed TAU

- TAU addressed five issues:
  1. What would be the health impact?
  2. The budget impact?
  3. The cost-effectiveness?
  4. The opportunity costs?
  5. Ethical, legal, social issues?

TAU Approach

- Considerations

1. Health impact?

- 250 needlestick injuries reported / year
  - But of these only 26 are associated with IV lines
  - The proposed device no effect on other 249 injuries
- Assume: for every 26 reported another 26 are not reported
- Efficacy: Device prevents 83% of injuries

TAU Approach

Other considerations

- Most sources are not infective

  % infective: HIV 3%, Hep C 6.7%, Hep B 2.9% (93% vaccinated)

- Not all infectious injuries lead to infections

  Conversion rates : HIV 0.56%, Hep C 1.85%, Hep B 8.4%

- Treatment reduces conversion rates

  Reduction: HIV by 81%, Hep B by 85%

Health impact

A. Injuries prevented
   - **Use of 293,409 devices/ yr would prevent 43 NS Injuries**

     [26 reported +26 unreported = 52 x 83% = 43]

B. Infections prevented
   - **HIV 1 case every 227 yrs** (C1 109-555)
   - **Hep B 1 case every 238 yrs** (C1 123-555)
   - **Hep C 1 case every 19 yrs (C1 10-71)**
     - (early treatment of Hep C cures 85%)

C. Reduced fear and inconvenience
   - Seven individuals avoid 28-day HIV therapy

2. Economic impact

Net cost = $137,699/year

Device: $0.57 x 293,409 uses = $167,243/year

Less cost of treating 26 injuries = $27,677/year

Less cost of treating 1 Hep C = $1,867/year

If the objective is control of infection:

The cost of preventing one case of Hep C infection every 19 years = $2,642,975

3. Opportunity Cost

- **Roughly equivalent to 1.2 acute medical beds**

  (1.2 beds = 55 patients who will **not** be admitted in one year)

4. Ethical / Legal Questions

- To not do it implies that we don't care for our staff.
- Everyone else is doing it.
- Legal problems. The courts decide on what is "usual" care.

The decision

Hospital HTA

	Technology	Acquisition Recommended	Advice Accepted
2002	1) IV safety catheters	No	Yes
	2) Antiviral treatment of chronic Hep C	Yes	Yes
	3) Mitoxantrone for Multiple Sclerosis	Limited	Yes
	4) GPIIb/IIIa inhibitors for PCI	Limited	Yes
2003	5) L-M-W Heparin for DVT/PE	Yes	Yes
	6) Colorectal stents	Yes	Yes
	7) Video Capsule endoscopy system	No	Yes
	8) Risk of PRCA.? Use of Eprex	Yes	Yes
	9) Drotrecogin alfa (activated) in sepsis	Limited	Yes
	10) Drug eluting stents for PCI	Limited	Yes
	11) Implantable cardiac defibrillators	Limited	Yes
	12) Esophageal stents for dysphagia	Yes	Yes
2004	13) Biventricular pacing for heart failure	No	Yes
	14) Gliadel wafer for malignant glioma	Limited	Yes
	15) Gastric banding for morbid obesity	No	Yes
	16) Matrix coils for cerebral aneurysm	No	Yes
2005	17) Stem cells from unrelated donors	Yes	Yes
	18) Probiotics for C Difficile	No	Yes
	19) Expansion of VAC wound therapy	No	No
	20) Neuro monitoring in spinal surgery	Yes	Partly

Hospital HTA

	Technology	Acquisition Recommended		Advice Accepted	
	21) Microdialysis after brain trauma	No	Yes		
	22) Botox for refractory anal fissure	Limited	Yes		
2006	23) Testing for HER2 +ve breast cancer	Yes	Yes		
	24) Mitoxantrone for MS (update of 4)	Limited	Yes		
	25) Needlestick safety devices (update of 1)		No	No	
	26) Wait times, MUHC 1 (IMAGING,ORTHO,CATARACT,CARDIAC)		n/a	n/a	
	27) Wait times, MUHC 2 (MEDICINE<SURGERY)	n/a	n/a		
2007	28) Navitrack computer assist system	Limited	Yes		
	29) Drotrecogin alfa in severe sepsis	Limited	Yes		
	30) Pulsatile perfusion for renal transplant		Yes	Yes	
	31) Wait times, MUHC 3 (FRACTURE MANAGEMENT)	n/a	n/a		
2008	32) Wait times, MUHC 4 (DIAGNOSTIC IMAGING)	n/a	n/a		
	33) Impact of TAU reports	n/a	n/a		
	34) Coblation Tonsillectomy	No	Yes		
2009	35) Gliadel Wafers (CARMUSTINE IMPLANTS)		No	Yes	
	36) Opportunity Costs of new technologies		n/a	n/a	
	37) Impella Pump for C-V Support	Yes	Yes		
	38) DBS for Parkinson's Disease	Yes	Yes		
	39) Radio-frequency ablation (RFA) for liver cancer			Yes	Yes
	40) Acellular Dermal Matrix, breast reconstruction		Yes	Yes	

Hospital HTA

	Technology		Acquisition Recommended	Advice Accepted
2009	41).Collatamp for post colo-rectal surg infections		Yes	Yes
	42).Matrix Coils for C-V aneurysms. (Update)		No	Yes
	43).Collatamp to prevent post-Cardiac infection		No	Yes
	44).Probiotics for C.Diff diarrhoea. (Update)		No	Yes
	45).Transcatheter aortic valve implant (TAVI)		Yes	Yes
	46).RFA for Barrett's oesophagus	Yes	Yes	
2010	47).Ultrafiltration for heart failure.	Yes	Yes	
	48).Negative Pressure Wound Therapy.	Yes	Yes	
	49).Argon beam coagulation	Limited	Yes	
	50).Aortic valve bypass for aortic stenosis		Yes	Yes
2011	51).X-ray/gamma ray irradiation of blood.	No	Yes	
	52).Fiducial Markers for irradiation of Ca prostate		Yes	Yes
	53).VerifyNow to detect Clopidogrel resistance		No	Yes
	54).Probiotics for prevention of C Diff diarrhoea		No	Yes
	55).Drug eluting stents.Current indications.		NA	NA
	56).Subglottic drainage endotracheal tubes		Yes	Yes
	57).Binax Now for Diagnosis of Strep Pnumonia		No	
2012	58).Drotrecogin Alfain severe Sepsis	Withdrawn	NA	
	59).Acellular Dermal Matrix, Breast Reconstruct.	12Mth Appro		Yes

Hospital HTA Technology	Acquisition Reccomended	Advice Accepted
60). Videocapsule Endoscopy	Yes	Yes
61). 532nm KTP Laser for vocal fold surgery	No	Yes
62). Pro-Calcitonin assay for antibiotic coverage	No	Yes
63). Intrabeam for Breast Cancer	No	Yes
2013 64). Rituximab in Neurologic Autoimmune Diseases	Limited	
65). Impact of TAU Reports	NA	NA
66). Islet Cell Transplantation		
67). Hybrid OR for CVT procedures. Analysis	NA	NA
68). Balloon Catheter Dilatation for Chronic Sinusitis	Limited	
69). Hyaluronic Acid Fat Graft Myringoplasty	Yes	
70). TAVI Update	Yes	
71). Sutureless Aortic Valve		
72). Renal Artery Denervation for Resistant Hypertension	Yes	

Technology Assessment Unit

Results

2002-2011, 57 reports. 63 recommendations:

- **45(71%) incorporated into hospital policy.**
- **Budget savings approx $ 1 Million/yr**

40% recommend acquisition.

Because: Benefits proven & substantial. Costs justified.

60% recommend rejection or limited use.

Because: Benefit too small to justify costs, or

Benefits significant, but **++ *Opportunity Costs***.

Opportunity Costs

- They are seldom considered by decision-makers. To ignore them is extremely dangerous.
- Canadian hospitals work with fixed budgets.
- Each new acquisition it is made at the expense of something else.
- $137,000 for needlestick devices means $137,000 less for something else (nurses, secretaries, cleaners, beds).
- My hospital commits ***each year*** a new $6.5 million recurring, for unreimbursed new technologies.
- This is why our hospital capacity is a little too small.
- ***It is the principal cause of wait times.***

Issues to consider,
when trying to increase the use of evidence in hospital policy decisions.

- Hospitals are operated by professionals

  Acceptance of policy depends more on conviction than authority

  So to be ***accepted*** decisions must be ***sound*** and ***fair***

  And ***transparent***

- Sound decisions need good evidence

  (Many institutions have no mechanism for the collection or analysis of the evidence)

Issues to consider

- But fair decisions depend on more than facts
- Facts only inform policy.
- Decisions are based on values. **Whose values?**
- An ***unbiased*** group, representing the ***whole*** hospital, or

  A few administrators and department heads.

  Of course the administrators must have the last word.
- Stakeholder support promotes acceptance
  - Identify stakeholders; make them part of the process.

Message

- Most of us work in a vast complex organisation.
  somewhere in the Canadian Health Care System
- So big, it can only be changed from the centre.
  By the people with power.
- And little people at the workface are powerless.
- ***But this is not true.***
- Often, it is ***only*** at the workface
  that we can see what needs to be done
  and do it.

- We have been talking about one sort of problem, resource allocation, in one type of institution, the hospital or health region.

- To what extent are the problems that you face, and the context in which you work, comparable?

- I hope that some of this may be relevant to you and your problems.

Thank you

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