WHY IS AMERICAN HEALTH CARE SO EXPENSIVE?

THE COST OF HEALTH CARE IN THE US IS HIGHER THAN ANYWHERE ELSE IN THE WORLD, AND YET WE ARE NOT HEALTHIER THAN OUR PEER NATIONS. IN FACT, IN TERMS OF SUCH MEASURES AS INFANT MORTALITY AND LIFE SPAN, WE DON'T MEASURE UP. WHY IS THIS? MANY PEOPLE INVOLVED IN PROVIDING OR RECEIVING CARE HAVE SOME PRETTY GOOD IDEAS ABOUT WHAT COSTS SO MUCH, AND WHAT WE CAN DO TO REDUCE COSTS AND IMPROVE QUALITY. SHARING THESE STORIES IS AN IMPORTANT STEP IN CREATING AFFORDABLE UNIVERSAL HEALTH CARE.

WEDNESDAY, FEBRUARY 13, 2013

How to make your own ultrasound gel (which is also sterile and edible and environmentally friendly) **UPDATED--NEW RECIPE**

I have been doing lots of bedside ultrasound lately and realized how useful it would be in areas far off the beaten track like Haiti, for instance. With a bedside ultrasound (mine fits in my pocket) I could diagnose heart disease, kidney and gallbladder problems, various cancers as well as lung and intestinal diseases. Then I realized that I would have to take a whole bunch of ultrasound gel with me which would mean that I would have to check luggage, which is a real pain when traveling light to a place where luggage disappears. I heard that you can use water, or spit, in a pinch, or even lotion, though oil based coupling media apparently break down the surface of the transducer. Or, of course, you can just use ultrasound gel.

Ultrasound requires an aqueous interface between the transducer and the skin or else all you see is black. Ultrasound gel is a clear goo, looks like hair gel or aloe vera, and is made by several companies out of various combinations of propylene glycol, glycerine, perfume, dyes,

phenoxyethanol or carbapol R 940 polymer along with lots of water. It is hard to find this information, but it is available in the material data safety sheets for the various companies that make it. The recipes are proprietary. Ultrasound gel is not super expensive, but it is not that easy to find in a store or in a developing country. It costs about $25 for 5 liters on Amazon, or $5 for a nice 8.7 oz squeeze bottle. It smells ever so slightly medicinal and leaves a sticky, then dry white residue as it dries.

There should really be some sort of powder that you mix up with water that makes ultrasound gel so we don't have to be shipping the water part of it, which is undoubtedly about 99% of the contents, long distances. But there isn't a powder. I have been looking. No instant ultrasound gel.

With a mixture of optimism and singularity of purpose I went to the kitchen and tried out 6 different recipes for an aqueous goo that would transmit sound waves. I thought that I could make ultrasound jam out of water and pectin, but that doesn't really work. Obviously there is something magic about fruit that makes pectin gel, maybe the acid or the sugar. Without fruit, even no-sugar pectin becomes about the consistency of spit. (I also tried spit, which does work, but has various obvious drawbacks.) I tried plain gelatin and water and got beautiful clear jello, which falls off the transducer, but kind of works, but is also messy. I tried corn starch and water, as if making extremely boring gravy. That was lovely and white, but the water wants to come out of it so it just slides off the transducer. I tried tapioca flour which I boiled with water, producing a nice clear, very mucoid gel which dries like glue on the skin and is very uncomfortable. I tried xanthan gum, a bacterial polysaccharide used to bind and thicken, boiled and cooled, and although it thickens the water it is slimy and falls off the transducer and makes a mess.

The recipe that worked (and worked great) is guar gum, salt and water. Guar gum has been used for a very long time in countries like India and Pakistan to thicken food and is now used often by people who can't eat gluten, to thicken gravies and make breads. Guar gum is the ground endosperm of the guar bean, which is very rich in a carbohydrate that avidly absorbs water. Guar beans are also eaten green and the pods are used as a vegetable ingredient after shelling out the beans. Guar gum is available in the flour section of many grocery stores and costs about $10 for a 220 gram bag. It is purported to be good for diarrhea, constipation, diabetes and lowering cholesterol. It has been added to infant tube feed formula in intensive care units to decrease stool frequency.

I messed with the recipe awhile and came up with a very nice slightly caramel tinged ultrasound gel this way:

1. Mix 2 teaspoons of guar gum with 1-2 teaspoons of salt. (The amount of salt isn't vitally important since it is just added to keep the guar gum from clumping. Using slightly less than a teaspoon of salt per 2 cups makes a gel with which is isotonic, which would be ideal for use near eyes or other mucus membranes or on open wounds).

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ABOUT ME

JANICE BOUGHTON
IDAHO

I have been a primary care internist for over 20 years and am now practicing hospital and primary care medicine as a locum tenens physician. Ever since I finished medical school I have been disturbed by various aspects of the practice of medicine that make no sense. The present debate over the reform of health care makes fixing these things relevant to nearly everyone's well being. If we can stop wasting time and money on things that don't make anybody healthier or happier, the cost of providing health care to every American becomes affordable.

VIEW MY COMPLETE PROFILE

2. Boil two cups of water.

3. Slowly sprinkle the guar gum/salt mixture into the boiling water while stirring vigorously with a fork or whisk.

4. Boil for about 1-2 minutes until thick and well mixed.

5. Cool before using. Save lives.

This is wonderful ultrasound gel (see photo above). I tried it and it works at least as well as the proprietary stuff, and probably doesn't dry out quite as fast. It wipes off easily and doesn't leave a sticky film. Even though it is not entirely transparent, there is no reduction in the quality of the ultrasound image compared with the standard clear ultrasound gel. It costs about 25 cents for a half pint, is sterile when you have finished making it and is completely non-toxic. The ingredients are available in many developing countries, not to mention the US. It is edible. It is not particularly bacteriostatic, though it could be made bacteriostatic with a little EDTA (but then it wouldn't be edible). It is probably best made and used for a couple or 3 days, then discarded if unused, though I kept some in a clean bottle at room temperature and it was stable and smelled fresh for over a week.

It is quite thick, like regular ultrasound gel, so it is a bit of a trick to get it into a squeeze bottle. A large bore funnel works, or the cooled gel can be squeezed into the bottle out of the cut end of a plastic bag. It can also be kept in a jar and used with a spoon.

This is kind of exciting. Now I will no longer be dependent on ultrasound gel manufacturers. If I was in Haiti, either I or someone at the house where I was staying could make up a batch of this the night before clinic and I would have fresh clean ultrasound gel with which I could be generous in my scans. The water wouldn't even have to be sterile since the stuff is boiled when it is made. Let there now be ultrasound in places that Amazon.com does not reach!

Here's a YouTube video of how to do it.

**This article has been very popular and readers have left all sorts of new good ideas as comments. In order to make good ultrasound gel it is really only necessary to have some kind of a powder that, when mixed with water, creates a mostly transparent gel which clings to the ultrasound transducer. Polysaccharides are good for this, and guar gum is one of the least expensive that is available worldwide. A reader, however, just told me that he used glucomannan powder in a proportion of 1/2 teaspoon to a cup of water. I just tried it and it is EVEN BETTER THAN GUAR GUM. It, like guar gum, is a thickener and emulsifier, it is used by dieters to decrease appetite and is safe both topically and internally. It is available online and probably in health food sections of grocery stores as a dietary supplement. Glucommanan is a cell wall component of many plants, including the roots of the Konjac plant.

Unlike guar gum it does not clump and can be mixed in cold water then allowed to thicken over a few minutes. If it is mixed into boiling water its texture is smoother than when it is made with cold water, and of course it is also sterile, which is very useful. It is almost completely clear, has no flavor or smell and leaves very little residue. Thank you commenter who goes by the name "addedupon"!

***Recently an article has come out in PLOS 1 looking at making gel with different kinds of flour-type substances readily available in markets in resource poor settings. They recommend using cassava flour which is actually the same thing as tapioca flour. The problem with this gel is that it is very glue-like and when I tried to wipe it and even wash it off of my skin, the remaining residue was very uncomfortable. When I have done ultrasound in Africa there is usually nothing available except maybe some flimsy toilet paper to wipe ultrasound gel off of the patient. It is certainly worth experimenting with different combinations (they also mention sorghum flour which sounds promising) but it is important to use them on yourself to see what they feel like when they are incompletely wiped off, as is the usual case.

POSTED BY JANICE BOUGHTON AT 8:40 PM 

38 COMMENTS:

Anonymous said...

Dear Janice,
I work in East Timor as an obstetrician with very limited resources. I have been using water instead of ultrasound gel for my obstetric scans , with very poor results. Today I managed to source some guar gum from Australia and make my own gel and it was fantastic! Thank you so much for the advice

APRIL 28, 2013 AT 5:31 PM

Janice Boughton said...

Thanks for letting me know! Please post how and where you got it here in the comments

APRIL 28, 2013 AT 7:42 PM

Janice Boughton said...

It is a trick to find guar gum in developing countries, even though it is produced in both Africa and India. It is an ingredient in various industrial products including hydrofracking fluid and so is available in huge lots, 2+ metric tons, at a cost of $1-2 per kg. Some producers will sell smaller lots or 1kg at a time. Alibaba.com, an amazon-like online warehouse out of China, has food and cosmetic grade guar gum and does deliver to Africa and all over Asia. It is possible to get it in the US online as well and in bags or bulk.

MAY 14, 2013 AT 7:09 PM

Anonymous said...

Janice
THANK YOU! I am a researcher, but not an expert in US gel, trying to develop a new simple hybrid optical-ultrasound method to detect and monitor TBI. Your article was very very helpful.

JULY 17, 2013 AT 4:43 PM

Andrew T said...

Hi,
I really appreciate the work you did and the post here to serve as a starting place for people like me. Can you tell me if you have any experience with how long a batch of guar gum gel might last at room temperature before things start growing in it or it becomes a microbial hazard?

AUGUST 28, 2013 AT 8:15 PM

Janice Boughton said...

When I was in Tanzania we used exclusively guar gum gel for teaching and a research project on malaria. We found that the gel can last as little as 2 days at room temperature before becoming a much thinner liquid. I think that was due to some bacterial growth. It did not smell bad, though. It lasted longer when I cleaned the bottles well and rinsed them with boiling water. It also lasted better if refrigerated, which is not often an option. We also found that it worked great for ocular ultrasound. We were looking at optic nerve diameter and it was completely non-irritating when used on the eyelid directly, even if a little got in the eye. We also found that the tiny sieves that they had in the market in Tanzania, I think they were for making tea, worked great as a way to sprinkle the powder into the boiling water. We sometimes used a little more than a teaspoon of guar gum for a cup of water, just depending on what consistency we were looking for. I would suggest re-making the gel every 2-3 days and cleaning the bottle or jar well with boiling water between batches. I also found that I could pour very hot water or gel into the standard gel containers and they held up fine, didn't melt, which was good for sterility. Also the just boiled gel pours much more easily than after it cools when it thickens considerably.

AUGUST 29, 2013 AT 12:10 PM

Carrie said...

Janice,

You.Are.Awesome.

SEPTEMBER 22, 2013 AT 7:52 PM

Anonymous said...

Thanks for the feedback. I am a resident and will be traveling abroad in a couple months and saw that this might be helpful. I bought some guar gum and tried some experimenting and also noticed some growth after about two days. One thing that also seemed to be a potential challenge was having to boil water in order to make the gel. I tried stirring in some powder into room temperature water but as you mentioned this was likely thicker than the same ingredient ratios at a higher temperature, and I was stuck with all of these bubbles in the gel after mixing which would have ruined any images. It seems the water boiling part is not easily sidestepped. However perhaps there is still potential applicability. Thanks again for your informative post and response!

SEPTEMBER 28, 2013 AT 6:29 PM

Anonymous said...

Hi,
Mix the guar gum with vegetable glycerin (just enough to wet it) before adding to the water (which can be room temperature which takes care of the issue of boiled water). This will prevent the gum from forming into balls and you don't need to blend it as much. If you do get air bubbles in your gel, just smack the container on your open palm and the bubbles will work themselves up to the surface. Glycerin is also a preservative to a limited degree, but should make the gel last a bit longer. I've never made ultra sound gel, just lots of other natural product, fyi.

NOVEMBER 28, 2013 AT 10:51 AM

Anonymous said...

Might it be possible to use a Dakin's base if you needed a batch to last longer? - Phil

DECEMBER 5, 2013 AT 5:08 PM

Anonymous said...

I can supply fine guar gum powder in 1 kg and 5 kg bags from Pakistan. Looking for a distributor who can deliver to customers. 1 kg bag will cost USD 10 and will be able to produce about 25 kgs of ultrasound gel by mixing tab water. regards ABDUL WAHID e-mail: gazianieng@hotmail.com

APRIL 21, 2014 AT 12:12 AM

fenn said...

I've never seen guar gum in any grocery store.

why not use commonly available hand sanitizer gel? it's definitely not going to go sour, although you wouldn't want to

get it in your eye. the active gelling ingredient is carbomer, a common cosmetic ingredient also used in aloe vera gel and hair gel. it also contains 50% alcohol and glycerin.

APRIL 27, 2014 AT 6:57 PM

Janice Boughton said...

Hand sanitizer gel is fine in a pinch, but evaporates so fast that you have to keep on applying it. Also high alcohol containing products will break down the transducer's glue. The main arguments for guar gum are that it is lightweight, so you can transport the equivalent of a lot of gel in a small package, and don't have to deal with airline restrictions on transporting fluids, that it is nontoxic and non-irritating (no problem using it on eyes or mucus membranes) and that its consistency is very like commercial ultrasound gel.

APRIL 27, 2014 AT 7:42 PM

Janice Boughton said...

Re: availability. That can be a problem. I buy it online or at the local coop. Much cheaper online (Amazon has it.)

APRIL 27, 2014 AT 7:44 PM

addedupon said...

i just tried making the gel but used glucomanon in the raitio of 1 teaspoon to 2 cups of water with salt. It looks very good. We'll see how that works. My glucomanon is white powder fiber and absorbs more water.

Thank you very much for this fabulous idea!

JUNE 2, 2014 AT 5:35 PM

Janice Boughton said...

I just tried using xanthan gum again. It works fine. Even though it is supposed to thicken more than guar gum, it's pretty much the same ratio: 1 teaspoon to a cup of water. It doesn't get quite as thick, but basically it's the same, and sometimes it's available when guar gum isn't.

JUNE 5, 2014 AT 7:43 PM

Janice Boughton said...

I'm going to try the glucomannan. Great idea! 8 oz cost me $12, and if the ratio is better that is competitive with guar gum. Xanthan gum is a little more expensive.

JUNE 5, 2014 AT 8:15 PM

Amy said...

Has anyone tried...just squeezing some natural aloe vera gel from the slit open aloe leaf?

JULY 31, 2014 AT 10:09 PM

Lucas said...

Thanks! I tried the guar gum recipe and it works very well with my abdominal toning belt. I find it a little bit cheaper than the glucomanon option, at least in the UK.

SEPTEMBER 7, 2014 AT 2:35 PM

Anonymous said...

Janice,
Would vaseline work? Could you try it and post your results?
Thanks!

SEPTEMBER 24, 2014 AT 5:00 AM

Janice Boughton said...

Yes, but it is messy and bad for the machine. I have used lotion and hand sanitizer and could probably use yogurt or gravy or jello or lip balm or hair gel or any number of goopy things which are sonolucent. I particularly like aloe gel because you can just rub it in, not off. The ground rule is that you want to avoid irritating the skin of the patient and destroying the machine. The main point is that you don't actually need ultrasound gel and that there are some pretty easy recipes that allow you to make gel when you can't buy it. I've been to ultrasound conferences where they ran out of gel at the hands-on stations and had to run out and buy lubricating jelly at a pharmacy, which was inconvenient, and in rural areas where there is no lotion or aloe vera gel or hand sanitizer and certainly no pharmacies but there is water. So many ways to work the problem.

SEPTEMBER 27, 2014 AT 4:47 PM

Nomadic Health said...

Janice, thanks for all the great info. I tried using 2 tsp/2 cup water glucomannan in Chad, Africa this past week. I added a tsp of salt and 1/2 tsp boric acid (antibacterial) as preservative. It calculates out to just over 32 cents (US) for the two cups. So far so good.

NOVEMBER 1, 2014 AT 10:30 PM

Nomadic Health said...

Janice, thanks for all the information.

I tried using glucomannan powder (Puritan's Pride on Amazon) in Chad, Africa this past few weeks. 2 tsp per 2 cups water. The thickness is good because it doesn't run off the sides of a hot

pregnant abdomen too easily.

I added the 1 tsp salt and then for a preservative I added 1/2 tsp boric acid (antibacterial and anti fungal) because everything gets infected here (110 degrees right now). So far so good.

I had no problem getting it into the dispensing bottle because I poured it from the sauce pan into the bottle fairly soon after all ingredients had gone into solution.

I did have bubbles as mentioned by our traveling resident but they did not interfere with imaging as I believe they are squished to the side by the application of the probe to the skin.

I estimate my cost of the two cups at just over 32 cents (US).

NOVEMBER 1, 2014 AT 10:49 PM

Jay Reimers said...

You can buy the powder you described. Carbopol 940 can be bought from most DIY cosmetics suppliers (makingcosmetics.com). It is a much more effective thickener. 0.5% wt/wt is all you need. I would suggest a 0.5% wt/wt solution with 0.5% potassium sorbate, as a preservative. Adjust the pH to >6 with baking soda. The higher the pH, the thicker it will become.

DECEMBER 13, 2014 AT 9:25 AM

Janice Boughton said...

I tried the Carbapol 940. It requires that the pH be above 6, which should be OK since most tap water is above that, but distilled water is sometimes lower than that. I tried tap water, with and without baking soda, hot and cold, with the ratio of 0.5% weight to weight (which was about 1/2 teaspoon to a cup of water). It made a slightly viscous water. Then I used twice as much powder. It was slightly thicker, but still not a gel. I watched a video of making a gel with carbapol 940 and they used an electric mini-mixer and checked the pH with litmus paper. If that is required to make it work, I think it will be impractical in resource poor settings. If someone else has gotten it to work, please post a comment. I would love to see a homemade gel that lasted longer than a couple of days at warm temperatures

JANUARY 14, 2015 AT 1:18 PM

Jess Estrellanes said...

Hi Ms. Janice Boughton. I am from the Philippines. We are having a hard time looking for a guar gum. Is there a chance that it is available in our country? Thankyou!

MARCH 3, 2015 AT 9:36 PM

Janice Boughton said...

I know that both the glucommannan (I think it is sometimes called Konjac) and guar gum can be hard to find. I have heard that in areas near you that you can get it from Australia, ordering it online. Alibaba has it but mostly in large lots, smallest lot I saw was 25 kg, but I didn't look that hard. Keep looking. If you have a reliable mail system or DHL you can probably get it for pretty cheap.

MARCH 18, 2015 AT 12:33 PM

Anonymous said...

Hello! Good morning!!! I'm a student- taking up Bachelor in Physical Therapy from the Philippines. now my question is that, can you suggest any ingredients aside from guar gum, if it is okay,because i want to conduct a research on how to make an alternative ultrasound gel.

JUNE 8, 2015 AT 7:15 PM

Janice Boughton said...

Just think of what you use in the Phillipines as a thickener for food. Many countries have something the use that is different from what we use in the U.S., which is mostly wheat flour, cornstarch and tapioca. I discovered can than gum and guar gum because of gluten free cooking. Glucomannan powder was a discovery of a reader. Go for it. Experiment! Make sure it doesn't cause skin or mucous membrane irritation.

JUNE 9, 2015 AT 10:23 AM

Anonymous said...

hello ma'am! i'm the one who asked you if you can suggest any ingredients aside from guar gum. there is this article that they used aloe vera as ultrasound gel. can i seek some help from you, 'cause i can't see any plant that can be used also as ultrasound gel aside from aloe vera. thank you.

JUNE 10, 2015 AT 9:37 AM

MaryAnn Malecki said...

I am highly allergic to propylene glycol. It seems to be in everything medical, yet nurses and technicians may write it on my allergy list, I have explain its in ... Yet I am told over and over, we use surgical wipes, ultrasound gel, sleep study electrodes, etc daily. They are safe. These "people" are not with me for the next 10+ weeks with predizone and being covered head to toe with red, itchy, burning spots. I am post menopausal and spotting, so I have yet another ultrasound next week. How do I get "intelligent" medical professionals to listen to me and "do no harm"? As I ramble, yes, my throat only closed up with penicillin, yet the rashes get worse each time. A yeast

infection last month, and chicken me called the pharmacy to check ingredients and guess what, it contained the propylene glycol. Pharmacy apologized over and over, gave me my money back and got a new script for me.

JANUARY 6, 2016 AT 7:21 AM

Anonymous said...

Dear Janice,

Apart from being allergic to formalin and denatured alcohol, I am, as MaryAnn Malecki, allergic to "something else" in ultrasound gel. After some exchanges with one manufacturer, propylene glycol seems to be the culprit. It appears that PG-free ultrasound gel can be found in the USA and Canada but not in Europe where I live.

I read your 2013 article with relief. I am about to make an appointment for a pregnancy ultrasound and will try your solution (hoping the ultrasound practitioner will accept). Before doing so, I have a couple of questions: you mention that after testing glucomannan, it works better because it is not clumsy. Glucomannan can be found under the name Konjac. I however noticed that Konjac products are not 100% Glucomannan but rather 80%. Is this a problem? Do you also add salt to Glucomannan or is this only for Guar gum?

And my 2 other questions are for my potentially skeptical or scared ultrasound practitioner: a) Over a scale of 100, 100 representing the screen clearness of an ultrasound performed using one of the main manufacturers gel, how would you rate your receipt? b) Do you think this home made gel (because of salt of whatever) could damage the ultrasound transducer?

One last very naive question to the practitioner you are: do you think that doing an ultrasound (with a regular gel) not directly on the skin but on a food plastic wrap placed on the skin could work?

Thanking you from France for your help!

SEPTEMBER 17, 2016 AT 5:23 AM

Janice Boughton said...

I've found that the salt isn't necessary in either one now. They are both fine without it which is simpler. With guar gum I just make sure to be whisking it vigorously when I add it to the boiling water. The picture is just as clear with homemade gel as regular gel. The only difference is the consistency which you can vary by how much glucomannan or guar gum you add to the water. I think the commercial gel is a little bit stiffer usually. Regarding the glucomannan, the stuff I get off of Amazon says

it is 100% Konjac so I would wonder what else they put in the stuff you looked at. Remember that just because these things are natural it doesn't mean you won't be allergic. You should try a little of whatever you plan to use on your skin to make sure you're fine. I've not seen a problem though. As far as harming the transducer, there is nothing that would have any ill effect. Often they warm about alcohol or oils but even those would have to be used extensively to have any effect. The homemade gel is essentially water with a tiny bit of powder. There is no possible effect on a transducer. The plastic wrap thing might work, with a little lotion or aloe between your skin and the wrap to get rid of the air but there might be some worsening of the image.

SEPTEMBER 17, 2016 AT 8:30 AM

Janice Boughton said...

"Warn" not " warm. Sorry. Doing it from my phone.

SEPTEMBER 17, 2016 AT 8:42 AM

Poppy said...

Can this be used with my Home ultrasound device which I use for pain relief?

NOVEMBER 30, 2016 AT 11:51 AM

Janice Boughton said...

Yes, Poppy, this ought to work for a pain relief ultrasound since it also uses the principle of transmission of sound waves through a water based gel. Keep in mind that you can also use aloe vera gel if you like, which is quite pleasant and doesn't really need to be wiped off.

NOVEMBER 30, 2016 AT 12:29 PM

Ross Jacobs said...

Can this be used with a LIPUS (low intensity pulsed ultrasound) device for bone healing? Can it be used intraoral? Thank you!

DECEMBER 2, 2016 AT 7:53 AM

Janice Boughton said...

Usually the mouth is wet enough not to need gel, but it is safe to eat. Gel just needs to transmit sound waves, so it should work for any ultrasound application.

DECEMBER 2, 2016 AT 8:20 AM

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