

## Appendix 4. Data supplement.

By Matthew P. Robertson

I prepared this Data Supplement as a way of further discussing some of the assumptions, problems, and difficulties associated with attempting to estimate the size of an industry that the Chinese government considers a state secret and around which it engages in deception and propaganda. The tone is meant to be reflexive and informal. If you are reading this, it means that you are quite interested in the topic and may benefit from hearing directly from someone who has spent a long time on it. The purpose is to provide a grounding for other analysts who may be wondering how they might possibly begin thinking through the basic credibility of a claim — for instance — that China is performing “tens of thousands” of transplants annually.

Like everyone else who researches and thinks about China’s transplantation system, the question of “transplant volume” has vexed me. I would very much like to know The Number, but reliably calculating it is simply infeasible at present. Short of that quixotic task, which I’ll return to at the end of this note, can we strike a compromise, and come up with a range that we can be highly confident about? How about a hard, rock-bottom minimum? This is what the World Organization to Investigate the Persecution of Falun Gong, and Kilgour, Matas and Gutmann did. *We sort of* did that, but presented it in a more general way. The point was simply to show that *whatever the number is*, it’s far greater than what the death penalty can explain. To my mind, given our information at present, that is the only function that The Number plays in this debate.

This guides how I approached the task: if we don’t actually *need* to know what the real figures are, we can simply avoid having the debate sidetracked by people who pick holes in whatever numbers we do come up with — which will necessarily be imperfect — and thus focus attention on the rest of the evidence. The Number functions like a trigger valve: once it’s clear we’ve “hit” some large (though somewhat indeterminate) value, it’s clear that death row prisoners become a simply implausible explanation.

This is the attitude that led to a close analysis of a convenience sample of ten (mostly) major hospitals, followed by the suggestion that given there are a total of 173 hospitals, the real number must be many times greater. These hospitals were chosen because in general, more information was available about them, itself a function of their size.

But perhaps this way of reframing the problem of The Number — to say it’s not actually a problem — will be found unsatisfactory. If that is the case the following is my response.

Any attempt to come up with a number relies on assumptions, and the best an analyst can do is make their assumptions clear, explain their pitfalls, and provide their results as transparently as possible.

Let’s begin with what the Chinese authorities currently claim about their transplant volume. According to the National Health Commission, China performed 20,201 transplants from 6,302

donors in 2018.<sup>1</sup> This figure was published in October 2019, and it appears to be the most recent annual claim. The last four years of official figures now looks like this:

Year	Donors (DD) <sup>a</sup>	Transplants (DD)	Transplants (total) <sup>b</sup>	Source
2015	2,766	7,478	10,057	Huang 2017, GODT
2016	4,080	11,060	13,263	Huang 2017, GODT
2017	5,146	14,190	16,687	Wang 2018, GODT
2018	6,302	17,674	20,201	Wang X-D 2019, GODT

<sup>a</sup> refers to deceased donors

<sup>b</sup> refers to both deceased and living donors

Before going on, it's worth pausing for a moment and reflecting on how we first obtained this data. In the case of both Dr. Huang Jiefu's initial figures of the voluntary reform (presented at the Vatican in February 2017)<sup>2</sup>, and Dr. Wang Haibo's updated data (presented at The Transplantation Society's biennial meeting in Madrid, July 2018)<sup>3</sup>, the source was a member of the audience who recorded the presentations on his or her cell phone. A version of the same figures later appeared in the Chinese press, but in both cases the original data was on powerpoint slides delivered to conference participants. If this individual had not recorded those presentations, the data would simply not have been available for social science research until the authorities published it through another channel. At that point, we wouldn't know if it differed from what had previously been presented.

A flavor of Dr. Wang's 2018 address is below.

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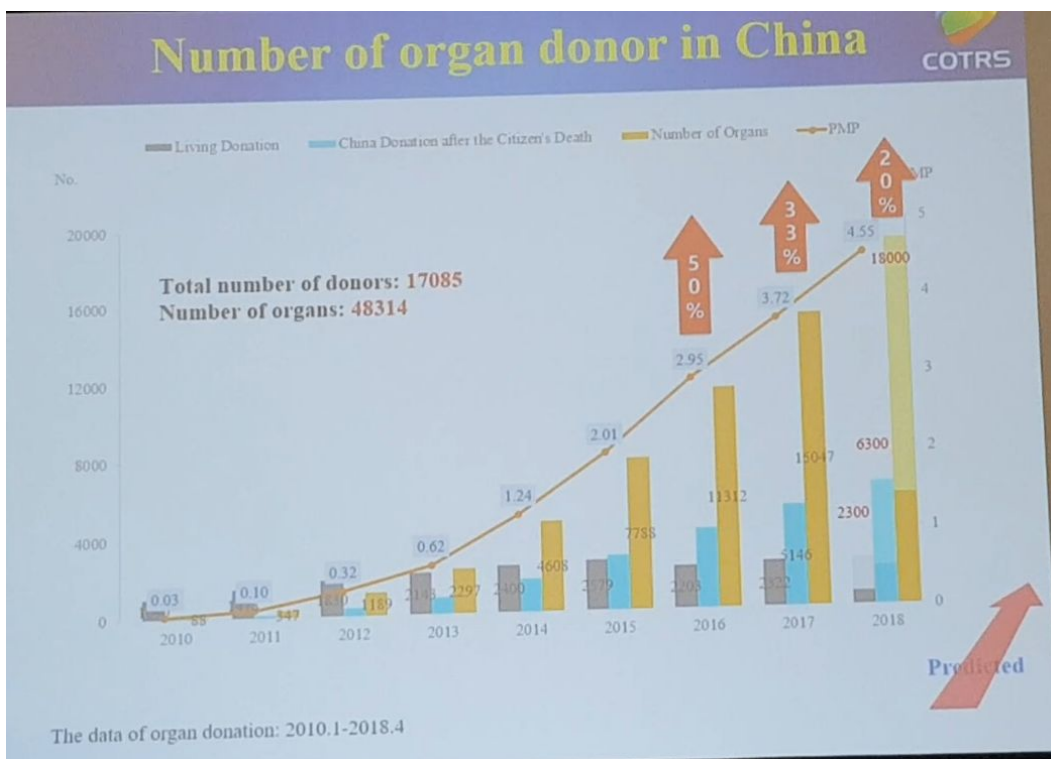
<sup>1</sup> Wang, "Organ Donation in China Ranks No 1 in Asia."

<sup>2</sup> Huang, "Global Summit on Organ Trafficking and Transplant Tourism by the Pontifical Academy of Sciences."

<sup>3</sup> *Wang Haibo Presentation at The Transplantation Society's 2018 Annual Meeting*. The extraordinary predictive acuity of Dr. Wang is worthy of note. In this July 2018 presentation, based on data as of April 2018, his slide "predicts" that the number of voluntary donors by the end of 2018 will be 6,300. In October of 2019 as noted above, state media reported that the number of donors in 2018 was in fact 6,302. Dr. Wang was off by only 0.03%.



The key new data is presented in the following slides (at 4:31 and 4:41 of the video in the reference Wang 2018).





In the past, the pattern was that after events like this Chinese media reports would republish the figures, usually in the form of quotes attributed to officials. This would suffer ambiguity — for instance, failing to distinguish between living and deceased donors, or failing to break out transplant growth by organ type, etc. In this case, Dr. Wang’s data fails to note how many of the liver transplants are supposed to be from living and how many from deceased donors.

More recently, given international scrutiny, these data have been provided to the Global Observatory on Donation and Transplantation, managed by the World Health Organization and Spain’s national organ procurement organization.<sup>4</sup>

What does all this mean, and where does it leave us?

To begin with, we now know that all of these figures were simply made up, as documented extensively in a recent *BMC Medical Ethics* paper.<sup>5</sup> But we can still use them as a starting point for thinking about China’s transplant capacity.

The claim of the capacity to perform 20,201 transplants (17,674 of which were from deceased donors) is significant in light of our defensible belief that the data was falsified. The complexity of transplanting organs from hospital-based deceased donors is far greater than from a captive, prison population. The *BMC* paper (specifically Additional file 6) contains an extensive discussion of these complexities, and the difficulty of China’s medical system to meet them.

<sup>4</sup> World Health Organization, Organización Nacional de Trasplantes, “Global Observatory on Donation and Transplantation.”

<sup>5</sup> Robertson, Hinde, and Lavee, “Analysis of Official Deceased Organ Donation Data Casts Doubt on the Credibility of China’s Organ Transplant Reform.”

Taking the authorities at their own word, therefore, the capacity to perform 17,674 transplants from 6,302 deceased donors speaks to a very advanced and busy transplantation system indeed. Assuming — for the sake of argument — that it required twice the medical resources to procure an organ from a voluntary, hospital-based deceased donor as it would to time the execution of a captive prisoner, the Chinese authorities' claim that it performed 17,674 transplants from 6,302 deceased donors means that it could just as well have performed 35,348 transplants from 12,604 prisoners.<sup>6</sup>

Of course, the above is a rhetorical move: taking what we know the authorities have lied about, then *assuming it is true for the purpose of making a point about what interests us*. This is a form of argumentation that, while not particularly probative as to the actual number of transplants taking place, is relevant to thinking about how China's claims might be publicly challenged. But it's not clear what it tells us about actual transplant volume.

Is it even possible at present to produce a defensible, bare-bones estimate of China's transplant volume over the last 20 years in a reliable manner? Nearly *all* data that researchers have obtained over the years comes in one way or another from the Chinese authorities, and we have an abundance of evidence that they manipulate and outright falsify both national, provincial, and hospital figures. So even the data we do use to triangulate and extrapolate claims must come with disclaimers. In the end we are forced to use such figures because they are the only ones we can obtain. But when we use such data to make estimates, it is difficult to think of such estimates as being especially reliable; their reliability is predicated on the reliability of the original data they were derived from. And we are confident that numerous of these figures are subject to arbitrary manipulation. To some degree then, these numbers all function as a kind of device to anchor our thinking, so we can feel confident in saying anything at all about the actual scale of transplant activity.

Let us now construct our transplant volume anchor.

For this exercise, we could begin again with official figures. According to an internal speech by Dr. Huang, in 2004 China performed 5.1 times the number of kidney transplants it performed in 2000.<sup>7</sup> Again according to Dr. Huang, China performed 5,500 kidney transplants in 2000.<sup>8</sup> China also performed 2,246 liver transplants in 2004, according to China's liver transplant registry.<sup>9</sup> Simply adding these three official claims up ( $5.1 * 5500 + 2246$ ) comes to 30,296.

We can fairly presume that — even if the annual number of kidney transplants in 2004 was in fact only 5.1 times that of 2000 — the real number of kidney transplants in 2000 was more than Dr. Huang claimed, since he presented those figures to the international transplantation community in 2010. By that point Chinese authorities had every reason to downplay what the figures would have been in 2000. We can also fairly presume that the number of liver transplants in 2004 was far

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<sup>6</sup> The different demand in medical resources is no doubt far greater than two times. Again, refer to the discussion in Additional file 6 of the BMC paper. In one instance at a major hospital in Shanghai, medical authorities mobilized *dozens* of medical workers over several days for one brain dead donor.

<sup>7</sup> Mao and Pan, “卫生副长黄洁夫在全国人体器官移植技术临床应用管理峰会上的讲话 [Huang Jiefu at the National Human Organ Transplant Technology Clinical Application Management Summit].”

<sup>8</sup> Huang, “Tomorrow's Organ Transplantation Program in China: Presentation in Madrid, Spain.”

<sup>9</sup> Jiang WS, Zhou ZY et. al, “China Liver Transplant Registry Annual Report 2011.”

more than reported in the official transplant registry. Yet when we simply triangulate these figures, we arrive at slightly over 30,000.

Similarly, we could arrive at a figure of around 30,000 by peremptorily cutting in half the minimum estimate of the KGM Report, itself based on minimum requirements stipulated by Chinese authorities. This would be to assume 50% bed occupancy by new transplant recipients with one month stays, while the rest of the transplant beds are occupied by former patients with complications. This is an unreasonably conservative, unrealistic estimate that fails to account for changing volume in different years and numerous other factors — yet it still results in a transplant number quite beyond what the authorities can explain with death row prisoners.

Finally, we could take the drastic, almost farcical step of assuming that China's other 163 transplant hospitals operated at only 10% of the average capacity of the 10 we studied in depth (and the exercise could be done again with different results if we used 20% or 25%) . This would assume that our sample, already made with conservative inputs and which produced an estimate of 14,000 transplants annually, was an extraordinary outlier. In that case, the remaining 163 hospitals would have performed an additional 22,820 transplants annually. This exercise leads to a total of 36,820.

In a sense, the above figures are no better than business consultants spit-balling minimum revenue projections for a flat first-quarter. In another sense, they are a rhetorical exercise intended to make a point. And in yet another sense, they also serve as an interesting thought experiment that might challenge our complacency about what “reasonable” estimates of transplant volume in China look like.

The thought experiment allows us to see, at the very least, that China's transplant numbers simply cannot be explained by death row prisoners, and some other source must have been used.

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As alluded to at the beginning, two questions remain: Firstly, is there some way at present to arrive at a more reliable estimate of transplant volume? Secondly, if we had unfettered access to hospitals in China, could we derive a reliable and accurate estimate of transplant volume that way?

On the first point: If resources were available — primarily in the form of money to pay for the time of highly skilled engineers — it would be possible to use machine-learning computational methods to systematically analyze tens of thousands of Chinese-language medical papers, and establish how many transplants they reported. The data resulting from this process could be triangulated with the telephone admissions, surgeon comments to the Chinese media, reports on hospital websites, and other data. All of these sources could then be brought to bear on estimates of transplant volume in specific hospitals over the period in question. Any estimate resulting from this process would still result on assumptions for interpolating missing data, and the complexities of the task hardly need to be stated, but it would at least be performed in a clear, rules-based manner with a large set of data to back it up. The entire codebase and datasets used for the exercise would also be made public.

Alongside this, it would be a good idea for an analyst to carefully examine the

hospital-by-hospital estimates of WOIPFG, translate them, and likely redo many of them. This human-directed process would serve as a robustness check on the systematic, quantitative process.

On the second point: If we could personally visit every transplant hospital in China and access their computer systems over the last 20 years, it would be possible to get a reliable estimate of transplant volume (obviously as long as the data hadn't been corrupted or destroyed). Specifically how this would be done, and specifically what data would be best relied on, is an open question. Would the surgery schedules be reliable and complete? Would the hospital pharmacies also have records of the patients taking immunosuppressant drugs? Clearly this scenario will not be possible absent major political changes in China. At that point it would likely become part of a major commission of inquiry, involving teams of investigators who gather records across the country. Before that happens, we must be satisfied with the necessarily imperfect estimates we arrive at using official sources.

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